DOCUMENT RESUME

ED 195 225 HE 013 341

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TITLE Schools of Public Health: Trends in Graduate Education.
INSTITUTION Association of Schools of Public Health, Washington, D.C.
SPONS AGENCY Health Resources Administration (DHEW/PHS), Bethesda, Md. Div. of Associated Health Professions.
REPORT NO HRA-80-45: HRP-0902582
PUB DATE Feb 80
CONTRACT 231-77-0007
NOTE 73p.
AVAILABLE FROM Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

EDRS PRICE MF01/PC03 Plus Postage.
DESCRIPTORS *Allied Health Occupations Education: College Admission: *College Applicants: *College Graduates: *College Students: Data Bases: Doctoral Degrees: Educational Background: Employment Projections: Enrollment Trends: *Graduate Study: Higher Education: Information Systems: Majors (Students): Masters Degrees: *Public Health: Student Characteristics: Trend Analysis

ABSTRACT

Major findings and trends relevant to school of public health applicants, students, and graduates during 1974-79 are summarized. These findings are placed within the context of a longer period that extends back to the early 1960s (in the case of graduates, to 1930) and forward to the year 2000. The limitations of the present data base on public health manpower for the purposes of planning are examined, and suggestions regarding future data requirements are offered. For applicants, information is presented on the following: relationships between applications, acceptances, and admissions during specific academic years: the distribution of applicants according to professional background: age, nationality, and sex of applicants: and distribution of applications according to desired area of specialization and according to degree program applied for. For students, information is presented on the following: enrollment trends, demographic characteristics, training and experience prior to entering public health studies, and aspects of current training programs. For graduates, information is presented on: numbers of masters and doctoral degrees for five-year periods beginning in 1930: and demographic characteristics: distribution of graduates by area of specialization. Appended data concern distribution of new public health students by state or country of origin: number of graduates for specific colleges from 1961 to 1979: and descriptions of areas of specialization. (SW)

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SCHOOLS OF PUBLIC HEALTH

Trends in Graduate Education

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U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION

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Contract No. 231-77-0007

February 1980

U.S. DEPARTMENT OF
HEALTH AND HUMAN SERVICES
Public Health Service
Health Resources Administration
Bureau of Health Professions
Division of Associated Health Professions

DHHS Publication No. (HRA) 80-45 May 1980

HE 011 341

HRP-0902582

DEC 19 1980

FOREWORD

Schools of public health are the major providers of graduate education and training for public and community health personnel -- individuals who are leaders in our national efforts to protect and promote the health of people and communities. Yet, for years, it has been difficult to assess the impact of education in public health, in part because no comprehensive and reliable method has existed for gathering information on how many of these personnel are being trained, and in what areas they specialize.

This study is one product of a contract between the Division of Associated Health Professions and the Association of Schools of Public Health. The data collection system established under this project has provided annual information since 1974 on applicants, students, graduates, and faculty in the schools, as well as information on educational costs and research activities.

A companion volume, Schools of Public Health: Educational Data Project, 1974-1979, provides detailed information on the project and the data it has produced. This report is more analytical in nature. The authors, Thomas L. Hall, formerly Professor of Health Administration at the University of North Carolina School of Public Health, Rudolph S. Jackson, a doctoral candidate at the same institution, and William B. Parsons, the project director for the association, have analyzed key elements and placed the public health school data in historical perspective. They have also identified what they believe to be particularly fruitful areas of inquiry and further research.

The analyses presented in this report are intended to serve health manpower planners, legislators, and, of course, schools and faculty members involved in educating public and community health personnel. We are pleased to have been able to assist in this effort.

David B Hoover

David B. Hoover
Acting Director
Division of Associated Health Professions
Bureau of Health Professions

April 1980

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TRENDS IN GRADUATE EDUCATION IN PUBLIC HEALTH

Overview

In 1975 the Division of Associated Health Professions of the Bureau of Health Manpower (Health Resources Administration, DHEW) contracted with the Association of Schools of Public Health (ASPH) to design and operate a data system which would record the characteristics of school of public health applicants, students, graduates, and faculty. Prior to this time there had been no comprehensive data base, maintained over time, which could be used for the purposes of manpower planning. With health manpower enrollments in the health professions growing rapidly and government increasingly concerned about the possibility of an eventual surplus, including perhaps public health personnel, it was clearly appropriate to strengthen the data base used to estimate future supply and requirements. Work on the ASPH data project began in July 1974 and by the end of 1979 data tabulations had been compiled for five cohorts of trainees. During this period there has been a constant refinement in survey instruments and improvements in the response rate such that there is now a wealth of detailed information about the schools and their clientele.

This report presents a summary of major findings and trends relevant to school of public health applicants, students, and graduates during the five year period, 1974-1979. These findings are placed within the context of a longer period which extends back to the early 1960s (in the case of graduates, to 1930) and forward to the year 2000. The report concludes with a section which examines the limitations of the present data base for the purposes of planning and makes suggestions regarding future data requirements. Separate ASPH reports present findings relevant to faculty characteristics and school expenditures, and annual reports prepared in past years provide detailed crosstabulations of applicant, student, and graduate characteristics by school and for all schools combined.

The Data Base: Definitions, Sources, Methods, and Limitations

Definitions. The public health manpower data base has been extremely variable over time as regards coverage, level of detail, and accuracy. To begin with there is no accepted definition of public health manpower and the prospects of developing one seem as remote now as in the past. Definitional problems abound: many different specialties come under the public health rubric; no licensure or registration requirements exist which could facilitate manpower characterization or tracking; public health personnel are trained at the baccalaureate, masters, and doctoral levels, and in recent years many non-degree training programs have been introduced; there are no reasonably standard patterns of job activities which would allow public health manpower categories to be defined by what they do; and various educational institutions offer public health training besides schools of public health. This report is based on an arbitrary, albeit functional

definition of public health manpower, viz, those trained in graduate institutions accredited by the Council on Education in Public Health. These are for the most part schools of public health, though in several cases they are departments within schools of medicine or of other health professions. The great majority of the graduates from these schools receive a post-baccalaureate degree, though here, too, there are some exceptions now that a few schools offer baccalaureate degrees in one or another of the public health specialties. No reference is made in this report to persons trained in public health outside of the schools of public health even though data are available for some specialty areas.

Sources. The primary data base for the period 1975-1979 is the annual survey conducted by each of the schools of public health. During the fall of each year schools distribute, collect, and verify data forms completed by each enrolled student. This information, along with less detailed, aggregate data on applicants, is forwarded to the ASPH for processing. Additional information is provided on graduates, faculty, school expenditures, and on current research. The estimated aggregate response rate for the 21 schools providing data for the academic year 1978-1979 was 92% for students and 100% for graduates.

The first year of full operation of the data collection system covered the academic year 1975-1976, ending June 30, 1976. For the prior year, 1974-1975, the schools were asked to provide aggregate[1] data on applicants, students, and graduates. Although this information is presumably accurate as to aggregate numbers and distributions by specialty, it cannot be used for the preparation of crosstabulations according to individual characteristics.

The four-year period from 1970-1971 to 1973-1974 represents a major gap in the statistical history of the schools of public health. No consistent data set has been found covering these years and for purposes of this report the schools were queried directly by the ASPH to provide limited aggregate data on students and graduates only.

The decade of the 1960s benefited from the efforts of Dr. James Troupin who was able to obtain rather complete aggregate data on applicants, students, graduates, and faculty. Dr. Troupin's statistical reports were duplicated annually for the information of the schools and brief summaries were published each year in the American Journal of Public Health (AJPH) and the Journal of the American Medical Association (JAMA). However, their use is complicated by problems of varying data completeness and consistency from year to year as well as by the inclusion of data from the two Canadian schools of public health during much of that time.

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[1] "Aggregate data" refers to information provided by the schools on numbers of applicants, students, etc., according to such variables as area of specialization, age, sex, and nationality, information which is not amenable to further disaggregation or crosstabulations not originally contemplated. Since 1975-1976 the schools have provided separate forms completed individually by each student, thus making it possible to develop crosstabulations according to any combination of variables desired.

Prior to the 1960s several reports, cited on the relevant tables, were found which provided summary data on school of public health graduates. Unfortunately, a four-year gap in the data series apparently exists for the academic years 1955-1956 through 1958-1959, and the number of graduates during this period is estimated by interpolation. Most data sources prior to the 1960s are government reports and these tend to be limited to tabulations on trainees who received either direct or indirect government sponsorship. As a result it is difficult to present a complete picture of school of public health training activities during these early years.

In the early 1970s investigators at Johns Hopkins University carried out, on contract with the Bureau of Health Manpower Education (DHEW), a survey of school of public health graduates from the years 1956-1972. In order to develop a master list of all graduates the Hopkins team apparently contacted the schools directly to obtain the necessary information. Regrettably, the final publication[1] reports only on respondents and on aggregate response rates without making reference to the original school-by-school cohorts of graduates. An independent data source is thus unavailable to help resolve the various discrepancies that appear in other published summaries or to fill in the data gap on graduates for the late 1950s.

Methods. The starting points for the trend analyses presented in this report were the detailed working tables, laboriously developed from multiple sources which, in the case of graduates, extend back almost 50 years. From these working tables summarized tabulations were developed for inclusion in each of the sections along with the interpretative text. For the benefit of those who may have occasion to update this time series in the future, some of the working tables are preserved in the Appendix. The methods and assumptions used to project the supply of public health graduates into the future are detailed in the corresponding section.

Data Limitations. Reference has already been made to the highly variable quality and coverage of public health manpower data. In many cases seemingly arbitrary decisions had to be made in order to reconcile conflicting data sets and to develop a reasonably consistent time series for purposes of trend analysis. Space allocated in the original working tables to explanatory footnotes tended to exceed that required for the tables themselves to the point that the footnotes became counterproductive. Three areas, in particular, presented problems, viz, citizenship, area of specialization, and degree awarded. The nature of these problems and the way each was resolved in this report are as follows:

(1) Citizenship. Foreign nationals holding U.S. immigrant visas, at least since 1975, are counted as "U. S. citizens" for purposes of analysis and all the rest are counted as "foreigners." During the 1960s, and perhaps earlier,

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[1] White, P. E., et al., Graduates of American Schools of Public Health: A Survey of Graduates, 1956-1972, Association of Schools of Public Health, Washington, D. C., 1976.

applicants, students, and graduates of the two Canadian schools of public health were included in the data series due to difficulties encountered in attempting a consistent disaggregation of these schools from their sister U. S. institutions. Given the relative enrollments of Canadian and U. S. schools during the 1960s this inclusion likely results in an overstatement of "American" graduates by about 8.6%.

(2) Area of Specialization. Dr. Troupin recorded 23 different areas of specialization for the 14 to 18 North American schools of public health operating in the 1960s, and the ASPH identified at least 46 different areas of concentration and specialty tracks offered by the 21 U. S. schools of public health in operation in 1978-1979. In 1977 the ASPH convened an Ad Hoc Committee for the purposes of proposing an abbreviated list of areas of specialization as well as associated definitions, nomenclature, terminology, and scope of action. The Committee submitted its report calling for nine named areas of specialization plus a tenth "other" category and this was approved by the ASPH Executive Committee in early 1979. Accordingly, the areas listed below, defined in greater detail in Appendix V, are used to track the trends in specialization in the several disciplines of public health.

Areas of Specialization

Biomedical and Laboratory Practice
Biostatistics
Environmental Sciences
Epidemiology
Health Education
Health Services Administration
Nutrition
Occupational Safety and Health
Public Health Practice and Program Management
Other

The adoption of this classification system will surely disappoint members of some public health specialties, most notably those not included under their own specialty designation. Regrettably, there is no uniform set of criteria by which one can make logical choices regarding which specialties should be listed separately and which should be combined with others. Public health specialty designations have evolved over many years and are defined by such diverse criteria as disciplinary skills required (e.g., biostatistics), professional degree held by those enrolled (e.g., public health nursing, public health dentistry), the location of the anticipated professional activity (e.g., international health),

and the target population served (e.g., maternal and child health). The nine areas of specialization listed above provide a functional accounting and appear consistent with the criteria used for their definition (see Appendix V). However, since certain specialty areas not listed above are of traditional and widespread interest, they are given individual consideration where this seems useful.

(3) Degree Awarded. A recent tabulation by the ASPH identified more than 26 major degree denominations in use by 21 schools of public health and back in the early 1960s when there were 12 U. S. and two Canadian schools, the number of different degrees awarded exceeded seven. For purposes of this report the various degrees reported by the schools were grouped into a maximum of the following categories:

Bachelors
Masters of Public Health (MPH)
Master of Science of Public Health (MSPH)
Other Masters
Doctor of Public Health (DrPH)
Doctor of Philosophy (PhD)
Other Doctorate
Non-Degree Program

For some tabulations degrees are divided only into bachelors, masters, and doctorates, and for the time series covering the output of the Canadian schools, the DPH (Diploma in Public Health) degree is included in with the masters (or MPH) degree category.

The following limitations and complications should be kept in mind by the reader when interpreting or working with these public health manpower data:

-Numerical values for data prior to 1976 should be interpreted with considerable caution and are likely to be accurate only to within 5-10% in the case of graduates and perhaps up to 15% for students;

-Available data since 1960 are probably adequate for the identification of secular trends in the characteristics of persons studying public health, with a few exceptions which will be noted individually;

-Interpretation of data prior to 1970 is complicated by the inclusion of two Canadian schools of public health in the statistical series;

-Trends and projections are further complicated by the lack of reliable bases on which to estimate the percentages of (1) foreign graduates who remain in the United States, (2) foreign nationals holding U. S. immigrant visas who in fact return to their countries of origin, and (3) persons who received two or more degrees from a school of public health. Each of these estimates is necessary to help translate the number of degrees awarded into the total number of persons actually available for service in the U. S. or in an international agency. As will be explained later in the section on projections, seemingly reasonable assumptions are made to reduce the potential impact of these sources of error but it would be nice to base these judgments on more solid evidence.

Those concerned with data sets can always find gaps or inaccuracies that limit their utility for planning and such constraints will certainly be noted in this report. However, these realities should not serve as an excuse for failing to make good use of this information which is available or for taking appropriate corrective actions for the future. These data on public health manpower are adequate for identifying the major trends that have occurred in the past and most especially in the recent past when the great majority of persons received their training. This report seeks to highlight these trends, to suggest why they occurred and their likely significance, and to make certain projections into the future based on the extension of present policies. The report also includes suggestions as to how the public health manpower data base could be further strengthened in years ahead.

Applicants

Schools will prosper or falter depending on the numbers and characteristics of those who apply for admission. Despite the evident importance of this vital ingredient to the educational enterprise, surprisingly little is known about the applicants to public health training, especially as compared to such professions as medicine and nursing for which detailed studies have been made as to applicant characteristics, origins, motivations, and correlates of academic and professional success. For the schools of public health the last ten or more years have generally been a "buyer's market," with most schools receiving many more applications than could be accommodated, despite rapidly growing enrollments. This felicitous situation for the schools in the aggregate has likely masked problems that have arisen from time to time in certain specialty areas and in some schools, particularly as they have had to cope with the recent shift towards younger and less experienced applicants. Moreover, without data on the average number of applications submitted per applicant or on the degree to which applicants are seeking admission to programs outside of the schools of public health, the schools have not yet had to be concerned about the true strength of the demand for their offerings.

As already noted, applicant data are provided directly by the schools on an aggregate (not individual) basis. For an ongoing statistical system the information now collected is likely all that can be justified but it certainly would be helpful to supplement headcounts according to such characteristics as age, sex, nationality, and professional background with periodic sample inquiries into academic qualifications, numbers of applications per applicant and types of institutions applied to, reasons for application, and the like. This section reviews such data as have been collected and identifies problems that could merit further study in the future.

Numerical Trends. Applicant data on all schools of public health first became available as a result of Dr. Troupin's efforts in the early 1960s. Table 1 summarizes the relationships between applications, acceptances, and admissions during those years for which such information is available. Three findings deserve comment: (1) there has been a steady and for the most part rapid increase in the annual number of applications; (2) the relationship between applications and acceptances remained relatively stable during the 1960s; and (3) data for the latter 1960s and latter 1970s show a moderate decline in the ratio of admissions to applications. From this last observation one might conclude that with applications increasing more rapidly than new enrollments, the schools will be able to raise their standards for admission. Impressions gained at a number of schools in recent years suggest that for at least some of the specialties this is not proving to be the case. Indeed, a reasonable hypothesis, unprovable but certainly consistent with available data and impressions, would be that there has been a substantial increase in recent years in the number of applications submitted per applicant, a development which would create an unfavorable ratio of student acceptances offered for every student admitted. If this hypothesis is substantiated, greater attention will need to be given to student recruitment in the future.

Table 1. Applicants, Acceptances, and Admissions to Schools of Public Health, Academic Years 1961-1962 to 1978-1979

ACADEMIC YEAR	NO. OF SCHOOLS REPORTING[1]	APPLICATIONS			ADMISSIONS		
		Number Made	Number Accepted	Percent Accepted	Number Made	As percent of Acceptances	As percent of Applications
1961-1962	14	2274	1465	64.4	*	*	*
1962-1963	14	2376	1545	65.0	*	*	*
1963-1964	14	2884	1827	63.4	*	*	*
1964-1965	14	3591	2194	61.1	*	*	*
1965-1966	15	4026	2543	63.2	1797	70.7	44.6
1966-1967	15	4100	2371	57.7	1802	76.0	43.9
1967-1968	17	4709	2682	57.0	1947	72.6	41.3
1968-1969	17	5215	2965	56.8	2100	70.8	40.3
1969-1970	18	5999	3321	55.4	2317	69.8	38.6
1970-1971	*	*	*	*	*	*	*
1971-1972	*	*	*	*	*	*	*
1972-1973	*	*	*	*	*	*	*
1973-1974	*	*	*	*	*	*	*
1974-1975	19	9916	*	*	2980	*	30.1
1975-1976	19	10,870	*	*	2708	*	25.0
1976-1977	19	12,292	*	*	3317	*	27.0
1977-1978	20[2]	12,326	*	*	3427	*	27.8
1978-1979	20[2]	13,000	*	*	3735	*	28.7

SOURCE: Reports by Dr. James Troupin and ASPH Data Collection Center.

*Indicates that data are unavailable. Subsequent tables will use the same (*) convention.

1/ Includes the Canadian schools during the 1960s.

2/ Puerto Rico did not report.

Applicant Backgrounds. Table 2 represents the distribution of applicants according to professional background for all but four years of the period 1961-1979. Conclusions based on this data set are subject to a number of important uncertainties, viz, apparent changes in the background categories used over time; unexplained gaps in the entries for several categories in certain years; the likelihood that the applications per applicant ratio varies according to background category and that these ratios have been changing at different rates over time; and the great increase that has occurred in the number of applications classified as "other" or "unspecified."

Despite these limitations in the data set several findings merit comment. Most notable is the high proportion of "other" and "unspecified" backgrounds recorded for recent years. More detailed tabulations for the 1970s, not presented in Table 2, suggest that most of this rise is due to recent graduates without a defined professional background. This is consistent with the general trend in the 1970s towards younger applicants and a much higher proportion of whom are without prior professional training and experience. The actual proportion of applicants of unknown professional background is probably less than 20% of the total, especially during the latter 1970s.

Of interest is the moderate long-term rise in the number of applications received from persons with a health science background, even though the percentage of such applications declined substantially. The greatest increase is in the number of nurses and those in the "other" category, while the number of physicians has not yet attained the level noted in the late 1960s. In view of recent legislation which makes traineeships preferentially available to those with prior health training and experience and/or who are concentrating in certain specialty areas, it will be important to monitor these findings in the future.

Other categories that have shown the greatest increases include biological sciences, social and behavioral sciences, and most especially, "other" and "unspecified." This latter category is likely made up primarily of the many recent graduates who now apply without a defined professional background.

In tabulations not presented here it is interesting to note that during the latter 1970s approximately half again as many foreign applicants reported a health science background as did American applicants. This finding is not surprising given the older average age of foreign applicants and their greater tendency to seek training with prior institutional sponsorship.

Table 2. Applications to Schools of Public Health by Applicant Professional Background, 1961-1979

PROFESSIONAL BACKGROUND	ACADEMIC YEAR													
	1961-62	1962-63	1963-64	1964-65	1965-66	1966-67	1967-68	1968-69	1969-70	1974-75	1975-76	1976-77	1977-78 1/	1978-79 1/
	N=2274	N=2376	N=2884	N=3591	N=4026	N=4109	N=4709	N=5215	N=5999	N=9912	N=10552	N=12207	N=12286	N=12183
Health Sciences	41.9	40.0	38.3	44.7	42.3	35.7	36.6	32.0	33.5	14.4	14.0	16.4	19.7	18.7
Dentist	(3.5)	(3.2)	(2.6)	(2.8)	(2.8)	(3.8)	(4.0)	(3.4)	(3.0)	(0.9)	(1.0)	(0.8)	(0.8)	(0.9)
Epidemiologist	--	--	--	--	--	--	--	--	--	--	(0.2)	(0.3)	(0.4)	(0.4)
Nurse	(8.2)	(11.5)	(9.6)	(9.4)	(9.6)	(9.0)	(8.7)	(8.2)	(11.8)	(5.3)	(5.2)	(6.5)	(7.5)	(7.1)
Nutritionist	(3.7)	(2.6)	(4.3)	(3.4)	(3.9)	(3.0)	(2.7)	(2.4)	(2.5)	(0.7)	(0.5)	(0.5)	(0.9)	(0.7)
Physician	(24.2)	(20.4)	(19.5)	(18.4)	(16.5)	(17.4)	(18.9)	(15.9)	(13.6)	(5.5)	(4.5)	(5.3)	(6.4)	(6.4)
Veterinarian	(2.2)	(2.2)	(2.3)	(1.7)	(2.3)	(1.8)	(1.1)	(1.1)	(1.0)	(0.6)	(0.5)	(0.5)	(0.6)	(0.2)
Other	--	--	--	(9.1)	(7.3)	(0.7)	(1.2)	(1.0)	(1.6)	(1.4)	(2.0)	(2.5)	(3.2)	(3.1)
Biological Sciences	5.4	3.5	3.5	3.5	3.9	3.6	3.1	2.8	9.0	1.9	4.3	4.2	6.7	6.8
Math/Statistical Sciences	5.0	4.1	3.2	3.0	3.5	2.8	3.5	3.5	2.7	1.1	1.2	1.1	1.6	1.6
Chemical Sciences	1.5	1.2	1.5	1.3	1.1	1.6	2.0	2.4	--	0.6	0.7	0.8	1.4	1.2
Physical Sciences	--	--	0.5	0.6	1.0	--	0.8	0.7	--	0.4	0.3	0.2	0.4	0.3
Environmental Sciences	10.8	14.1	12.1	11.3	10.1	7.8	10.0	8.5	6.7	2.4	2.4	2.3	3.2	3.4
Information Systems/Data Mgmt.	--	--	--	--	--	--	--	--	--	0.3	0.4	0.6	0.7	0.4
Social/Behavioral Sciences	--	--	0.8	0.5	0.7	0.7	0.6	1.1	4.0	1.8	2.5	3.0	4.4	3.5
Administration and Planning	13.5	16.6	21.1	18.9	18.1	20.7	19.5	22.9	18.8	3.7	5.9	6.1	6.4	5.4
Education/Health Education	15.0	12.4	13.8	11.4	12.9	9.3	8.3	7.7	7.7	4.2	5.3	6.8	6.3	5.0
Other and Unspecified	6.9	8.2	5.1	4.8	6.4	17.7	15.6	18.4	17.7	69.3	63.1	58.5	49.3	53.6

SOURCE: Reports by Dr. James Troupin and ASPH Data Collection Center. Entries left blank indicate, for the most part, that the background category did not exist as such. It is not known whether the missing entries for the "physical sciences" in 1966-1967 and 1969-1970 reflect no applicants in this category or no data collected on this category.

NOTE: No data are available for the years 1970-1974.

1/ Unknowns for citizenship are not included.

Sex. The recent shift in the sex ratio of applicants is evident in Table 3, a ratio which parallels that observed among enrolled students and graduates. Unfortunately, it is not possible to determine the differential rate of acceptance and admission by sex, though at least for recent years there is no reason to expect any significant differences for men and women applicants.

Table 3. Applicants to Schools of Public Health by Sex, 1974-1978

ACADEMIC YEAR	MALE		FEMALE	
	NO.	%	NO.	%
1974-1975	5417	56.6	4155	43.4
1975-1976	5391	54.7	4465	45.3
1976-1977	5893	51.6	5522	48.4
1977-1978	5909	51.3	5611	48.7
1978-1979	5880	48.3	6287	51.7

SOURCE: ASPH Data Collection Center. Comparable data are not available for the 1960s although it is well established that the proportion of male applicants was much higher than female applicants. Percentages represent male and female respondents only. Unknowns for applicants of unknown sex do not exceed 7% for any given year.

Age. Age data on applicants are not readily available for the 1960s and the five-year series of the ASPH is too short to expect major changes to occur; indeed it would be very surprising to observe any further drop in the age distribution after the major one that took place in the 1960s and early 1970s. In recent years over 70 percent of all applications were received from persons under 30 years of age. Although not shown in Table 4, applications received from foreigners demonstrate a considerably older age distribution than do those received from U.S. citizens.

Table 4. Age Distribution of U.S. Applicants to Schools of Public Health, 1974-1979

AGE	PERCENTAGE DISTRIBUTION OF U.S. APPLICANTS BY YEAR				
	1974-1975	1975-1976	1976-1977	1977-1978	1978-1979
Under 25	35	43	43	44	40
25 - 29	36	33	32	32	32
30 - 34	15	13	14	13	16
35 - 39	6	5	5	6	6
40 and over	8	6	6	5	6
TOTAL NUMBER	6614	9252	9637	10,846	9962

SOURCE: ASPH Data Collection Center. Persons for whom information on age is unknown are omitted. Except for the year 1976-1977, when data from one school were unusable, the percentages of unknowns were 5% or less.

Desired Area of Specialization. Table 5 presents data for 1977-1978[1/] in the distribution of applications according to desired area of specialization as well as the ratio of applications to entrants for each area. Several findings merit comment:

-The data are surprisingly complete, with only a very small number of applications reported of unknown specialty preference.

-The ratio of applications to entrants is remarkably similar for six of the nine named areas of specialization, averaging close to 3:1. It should be noted again, however, that the number of applications per applicant may vary considerably among the areas and hence the applications/entrant ratio may not reflect accurately the relative attractiveness of the various specialties.

-The relatively high number of applications per entrant for the specialty "health services administration" is likely a real phenomenon, though its significance is less clear. Several possibilities could help explain this finding: (1) admission requirements to this field may attach less importance to prior

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1/ Similar comparisons were attempted for earlier years in the series but major gaps in the reporting of applications by desired area of specialization make this not practicable. This type of relationship should be monitored closely over time to assess both the constancy of the observed relationships and to detect early changes in applicant preferences.

training and/or experience and hence it receives proportionately more applicants with a baccalaureate degree; (2) this field may be perceived as being less well defined than other specialties and hence is preferred by those without specific career objectives; (3) this field may attract a significant number of persons who apply to it as a second choice, in case they are not admitted to their first preference specialty; (4) conversely, this field may be the first choice of many applicants who also apply to, and not infrequently end up enrolling in, other program areas; and (5) some of the apparent popularity of this field may be artifactual as a result of different criteria used in the classification of applications and of entering students.

-The very low (1.7:1) ratio of applications to entrants in the field of occupational safety and health is of concern though the situation is probably not as serious as is shown in the table. Differences in classification between the two categories are likely responsible for bringing the numbers of applications and entrants so close together but it also seems plausible that this important field has not received the visibility it deserves.

Table 5. Ratio of Applications to Entrants by Desired Area of Specialization, 1977-1978

DESIRED AREA OF SPECIALIZATION	APPLICATIONS TO AREA IN 1977-1978	ENTRANTS TO AREA IN 1977-1978	APPLICATIONS PER ENTRANT
Biomedical/Laboratory Sciences	351	113	3.1:1
Biostatistics	490	162	3.0:1
Environmental Sciences	1,524	378	4.0:1
Epidemiology	1,563	428	3.7:1
Health Education	678	234	2.9:1
Health Services Administration	4,570	893	5.1:1
Nutrition	545	229	2.4:1
Occupational Safety and Health	226	135	1.7:1
P. H. Practice and Program Mgmt	1,023	445	2.3:1
Other	1,171	386	3.0:1
Unknown	145	24	6.0:1
TOTAL	12,286	3,427	3.6:1

SOURCE: ASPH Data Collection Center. The number of unknowns is shown as a basis to judge the completeness of the data.

For lack of more detailed information over time as well as on applicant behavior regarding multiple applications and specialty preferences, it is hard to move beyond the above observations and conjectures. Perhaps all that can be said so far is that the schools seem to have adequate numbers of applications, that with the possible exception of occupational safety and health, none of the major specialty areas receives few applications, and that there is a need to look more closely, on a special study basis, at the determinants and dynamics of the application process.

Degree Program Applied For. The distribution of applications by type of degree sought and nationality is shown in Table 6. The principal findings are unexceptional: applications for the baccalaureate degree average a token one percent; over 80% of the applications from U.S. citizens are for a masters degree and approximately 8% are for the doctorate, with comparable percentages for foreigners averaging in the mid 70s and about 17, respectively; about half of all applications are for the MPH degree; and there has been little significant change in the distribution of applications by degree sought over the five years of observation.[1] The higher percentage of foreigners interested in studying at the doctorate level is likewise not surprising, especially now that many countries offer good public health training at the masters level. It is interesting to note that the distribution of applications by degree sought closely parallels the distribution of graduates by degree earned (Appendix IV), thus suggesting that the number of applications (though not necessarily of applicants) per degree awarded is approximately the same for all three major types of degrees (baccalaureate, masters, and doctorate).

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[1] The change in "other masters" from 1974-1975 to subsequent years is probably more an artifact than real; this rise is largely matched by a comparable decline in the percentage of "unknowns" and the percentages observed for other categories remain essentially the same.

Table 6. Distribution of Applications by Degree Sought and Nationality, 1974-1979

DEGREE SOUGHT	U.S. CITIZENS					FOREIGNERS				
	1974-75	1975-76	1976-77	1977-78	1978-79	1974-75	1975-76	1976-77	1977-78	1978-79
Bachelors	3.8	1.6	1.1	1.9	0.5	1.2	0.5	0.1	2.2	0.3
MPH	49.0	51.0	52.2	47.4	58.4	47.0	47.0	50.7	50.1	54.4
MSPH	3.6	5.5	3.2	2.8	4.3	3.2	3.6	4.2	1.8	4.4
Other Masters	20.8	24.8	29.0	37.5	23.7	19.4	19.2	21.1	26.0	19.4
DrPH	2.8	3.2	3.8	2.9	4.7	5.1	6.7	8.6	5.4	7.1
PhD	1.9	3.6	2.9	3.3	3.4	4.3	6.0	4.7	6.2	6.2
Other Doctorate	1.2	1.6	1.6	2.6	2.1	3.4	5.7	4.3	5.3	4.0
Post Doctorate	0.2	0.2	0.5	0.4	0.4	0.6	0.8	1.5	0.5	0.9
Special Students	2.1	1.9	1.6	1.3	1.9	0.4	3.4	1.6	1.7	3.0
Other	0.2	--	2.8	0.1	0.6	3.4	0.6	1.2	0.1	0.3
Unknown	14.5	6.6	1.3	0.8	--	12.0	6.5	2.0	0.7	--
TOTAL PERCENT	100.	100.	100.	100.	100.	100.	100.	100.	100.	100.
TOTAL NUMBER	8,744	9,382	10,771	10,891	10,635	1,162	1,170	1,436	1,395	1,611

SOURCE: ASPH Data Collection Center.

Students

The ASPH Data Collection Center provides a much richer source of information on students than on either applicants or graduates. As was noted in the introduction, student data are obtained directly from enrolled students and, once the schools complete and verify the responses, data are entered in the computer on individual files. Thus the ASPH not only has more information on each individual, but it can tabulate this information according to any combination of variables desired.

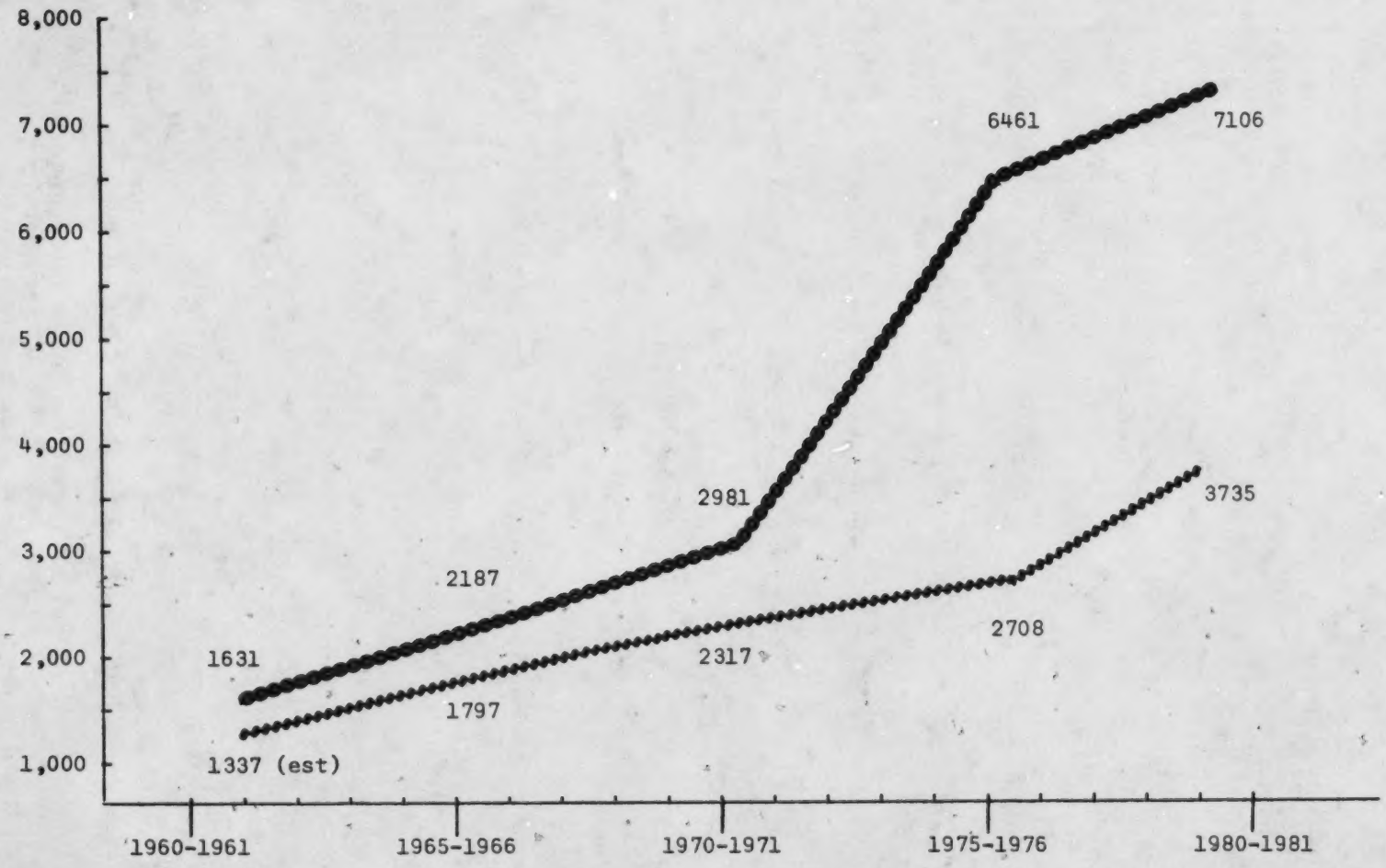
The lack of detailed information on graduates can, in large measure, be compensated by the abundant information available on students. Although student attrition rates have not been collected systematically for the schools of public health, there is good reason to believe that these are in fact quite low. If this is indeed the case, data collected on the characteristics of new students can be used as proxies for those of graduates several years later.

The annual output of student data has been prodigious and with 21 schools now participating in the data system, even a simple two-by-two table according to school can result in a large printout. The sheer bulk of the information produced annually may have served to retard its analysis and utilization. Without a time series available, trends are likely to go unnoticed, and it is those trends that are apt to be among the better sources of questions and hypotheses deserving further study. This section attempts to meet this need by providing year-by-year presentations of student data and, as appropriate, suggests developments that bear monitoring in the future.

The ASPH collects information on all students, both new and continuing, and annual tabulations are made for new and total enrollments. In this report primary attention is focused on the characteristics of new students for two reasons: (1) changes in student characteristics will be detected more quickly than is possible by monitoring total enrollments, which include students spread over multiple years of study; and (2) new students can serve as proxies for graduates, or school output, while total enrollments focus attention on the intra-school phase of manpower production, or school "throughput."

The remainder of this section considers four dimensions of students - enrollment trends, demographic characteristics of students, training and experience prior to entering public health studies, and aspects of current training programs. Unless otherwise indicated all tables in this section show the percentage distribution of students according to the variables under consideration, with applicable "N" values provided for those who wish to derive numerical estimates. Since data for 1974-1975 were collected from schools on an aggregate basis, some distributions cannot be calculated for that year.

FIGURE 1. New and Total Enrollments in Schools of Public Health, 1960-1979



LEGEND: Total Enrollments

New Enrollments

SOURCE: Reports by Dr. James Troupin and ASPH Data Collection Center.

NOTE: Data represents total respondents rather than total enrollments. New enrollment information was obtained from total respondents.

Enrollment Trends and Overview. School enrollments have increased rapidly since the 1960s due to three major forces: (1) a near doubling in the number of schools from 1960 (12 U.S. and 2 Canadian) to 1979 (21 schools); (2) a substantial increase in the average size of entering classes; and (3) a probable increase in the average duration of studies, especially as regards the masters degree which now requires two years at many schools. Figure 1 shows the dramatic rise in new and total enrollments that has occurred over the past 19 years.

This report is not concerned with an analysis of applicant, student, or graduate characteristics by individual school of public health. However, by way of general orientation to the different schools, Table 7 presents individual school profiles according to selected student characteristics.

Demographic Characteristics. The distribution of new and all enrolled students according to four demographic variables - sex, age, race/ethnic status, and nationality - are presented in Tables 8 and 9, respectively. The major findings offer no great surprises and can be summarized as follows:

- The data are impressively complete, with only nominal percentages of unknowns.

- The even split in the sex ratio is tending toward a higher percentage of females.

- Most students are young but a slight shift is evident in recent years towards the older age groups. More than one-fourth of the new students are under 26, an additional one-third are in their latter 20s, and most of the remainder are under 35.

- Four out of five new students are white (including Hispanics). Black enrollments amount to slightly more than half the representation of blacks in the general population and well below what would be necessary to correct the deficit of black public health professionals within a reasonable period of time. Likely the greatest concern is the lack of improvement over the five-year period despite the intensive efforts by the schools to increase black enrollments. The other minority groups seem to have adequate representation.

- The percentage of foreign students has remained impressively high at about 10% despite an appreciable decline in the international training component of the U.S. foreign assistance program in recent years. This percentage would in fact be higher if one included the substantial but unknown number of foreign nationals who are holding U.S. immigrant visas and are therefore counted as U.S. citizens in the tabulations.

- As a further observation, not documented in the table, approximately two-thirds of the new students reported no dependents, and the approximate percentages with dependents were as follows: one dependent - 12%; two - 7%; three or four - 9%; five and above - almost 2%.

Table 7. Selected Student Characteristics by Individual School of Public Health, Fall of 1978

CHARACTERISTICS	ALA	BERK	UCLA	COL	HARV	HAW	ILL	J.H.	L.L.	MASS	MICH	MINN	N.C.	OKLA	PITT	P.R.	S.C.	TEX	TUL	WASH	YALE	TOTAL
Total Enrollment	90	415	528	399	473	336	154	653	323	118	704	508	660	193	465	136	117	555	366	290	239	7722
Percent New Enrollment	40.0	61.2	51.9	56.6	54.9	53.9	62.3	47.6	44.3	33.9	48.9	48.2	48.6	42.5	41.5	*	53.9	51.7	51.1	37.9	34.3	48.4
Of New Enrollment, Percent:																						
Male	61.1	44.1	36.9	30.5	56.2	42.5	42.7	50.8	47.6	45.0	48.5	43.3	41.7	52.4	52.3	*	60.3	39.4	51.9	61.8	37.8	45.8
Foreign	11.1	10.6	6.2	4.9	14.2	11.0	2.1	16.7	21.0	--	11.0	8.6	4.4	8.5	9.2	*	7.9	10.8	20.3	10.0	4.9	10.6
Black	25.0	5.9	8.4	8.0	5.4	1.7	10.4	6.8	17.5	5.0	10.2	3.7	11.8	17.1	7.8	*	22.2	12.2	9.6	2.7	8.5	8.8
Other Minority	8.4	19.7	19.1	11.0	14.2	42.6	4.1	15.8	21.7	10.0	9.0	5.7	5.2	7.4	9.3	*	1.6	12.5	15.0	14.5	4.9	13.5
Masters Degree or Higher	22.2	57.1	30.7	43.4	77.3	31.5	35.4	66.2	23.1	12.5	27.3	23.3	35.2	43.9	42.0	*	20.6	47.4	29.9	38.2	24.4	40.7
With Health Experience	6 .1	59.1	47.6	66.8	53.9	63.5	60.3	55.4	35.7	42.5	50.0	71.3	56.4	53.7	38.4	*	55.6	56.4	44.4	52.7	52.4	54.4
With Health Specialization	27.8	33.5	20.8	38.5	38.1	38.7	37.5	43.4	33.6	15.0	20.9	48.6	27.4	30.5	16.1	*	28.6	26.5	39.0	27.3	26.8	31.8
Pursuing Doctoral Study Prog	--	8.6	7.0	9.7	13.6	1.7	12.5	22.8	13.3	--	8.2	5.3	15.0	30.5	12.9	*	--	18.7	3.2	15.4	10.9	11.5
Percent New Enrollees in:																						
Biomedical/Lab Sciences	--	5.1	--	--	4.2	3.3	--	7.7	--	--	1.5	3.3	6.9	--	5.7	*	--	1.0	2.1	4.5	--	3.0
Biostatistics	--	4.3	6.6	4.4	6.9	3.9	5.2	2.3	2.8	12.5	7.6	2.0	9.7	7.3	9.3	*	1.6	3.1	0.5	15.5	3.7	5.4
Environmental Sciences	2.8	9.4	6.9	5.8	10.4	9.4	9.4	9.3	2.8	10.0	17.4	13.9	17.1	26.8	13.5	*	15.9	14.3	4.3	14.5	8.5	11.4
Epidemiology	19.4	9.8	13.1	9.3	16.5	5.5	11.5	13.2	6.3	17.5	9.9	9.0	5.6	17.1	19.2	*	11.1	14.6	14.4	16.4	18.3	11.9
Health Education	5.6	13.0	13.1	1.3	1.9	11.6	2.1	8.0	37.1	25.0	8.1	5.3	7.8	2.4	--	*	14.3	2.8	--	--	6.1	7.5
Health Services Admin.	--	17.3	25.5	43.8	28.9	19.9	31.3	21.6	16.8	32.5	32.0	18.3	16.9	19.5	18.6	*	41.3	25.3	22.4	33.5	56.2	25.8
Nutrition	--	9.1	9.2	--	2.7	6.1	2.1	1.9	19.6	--	4.1	7.8	10.3	1.2	1.6	*	--	4.8	12.3	--	--	5.5
Occupational Safety/Health	8.3	1.6	--	1.8	6.5	1.1	21.9	2.3	--	2.5	4.1	4.9	4.0	11.0	8.8	*	6.3	8.4	0.5	9.1	--	4.4
P.H. Practice/Program Mgmt.	5.6	22.4	0.4	17.3	8.9	17.7	7.2	15.5	3.5	--	5.8	31.0	19.6	1.2	17.2	*	6.3	8.2	20.9	1.8	6.1	12.9
Other	--	7.1	25.2	12.8	8.8	20.4	7.2	14.8	6.3	--	7.3	4.0	1.5	12.2	5.2	*	1.6	15.0	5.3	3.6	1.2	9.6
Unknown Specialty	--	0.8	--	3.5	4.3	1.2	2.1	3.6	4.9	--	2.3	0.4	0.6	1.2	1.0	*	1.6	2.1	17.1	0.9	--	2.6

SOURCE: ASPH Data Collection Center

NOTE: Percentages are based on students for whom the variable is known. In all cases the percentage of unknowns is very low.

Table 8. Distribution of New Public Health Students According to Selected Demographic Characteristics, 1974-1979

NEW STUDENT CHARACTERISTICS	ACADEMIC YEAR (Figures are by percentage)				
	1974-1975 (N = 2921) 1/	1975-1976 (N - 2708)	1976-1977 (N = 3317)	1977-1978 (N = 3427)	1978-1979 (N = 3735)
Sex					
Male	45.5	50.8	50.0	49.4	45.8
Female	41.1	49.2	49.6	50.3	53.9
Unknown	13.4	--	0.4	0.3	0.3
TOTAL	100.0	100.0	100.0	100.0	100.0
Age					
Under 25	24.0	33.2	31.0	27.7	27.7
25 - 29	32.4	34.2	35.0	34.5	32.7
30 - 34	14.2	17.0	17.7	19.4	19.9
35 - 39	6.4	6.5	7.8	9.0	10.0
40 - 44	3.5	3.8	3.6	4.6	4.8
45 and above	5.4	4.6	3.9	4.1	4.1
Unknown	14.1	0.7	1.0	0.7	0.8
TOTAL	100.0	100.0	100.0	100.0	100.0
Race/Ethnic Status					
American Indian/Alaskan	1.4	1.0	1.3	1.3	1.1
Hawaiian	--	0.1	0.2	0.2	0.2
Asian/Pacific Islander	3.7	6.6	8.1	7.3	8.5
Black	6.9	7.3	8.1	7.0	8.8
Hispanic	1.7	7.1	6.0	5.6	3.7
White	73.6	73.9	74.9	76.2	75.7
Unknown	12.7	4.0	1.3	2.4	2.1
TOTAL	100.0	100.0	100.0	100.0	100.0
Nationality					
U. S.	87.1	88.8	89.1	88.9	89.1
Foreign	10.9	10.8	10.6	10.9	10.6
Unknown	2.0	0.3	0.2	0.2	0.3
TOTAL	100.0	100.0	100.0	100.0	100.0

SOURCE: ASPH Data Collection Center

1/ Only U.S. students are cross-tabulated by age and race/ethnic status for 1974-1975. Unknowns for citizenship not included in sex breakdown for 1974-1975.

Table 9. Distribution of All Enrolled Public Health Students According to Selected Demographic Characteristics, 1974-1979

ALL ENROLLED STUDENT CHARACTERISTICS	ACADEMIC YEAR (Figures are by percentage)				
	1974-1975 (N = 5821) 1/	1975-1976 (N = 6461)	1976-1977 (N = 6615)	1977-1978 (N = 6841)	1978-1979 (N = 7106)
Sex					
Male	52.7	52.5	51.2	50.0	47.4
Female	45.5	47.5	48.3	49.4	52.1
Unknown	1.8	--	0.5	0.6	0.5
TOTAL	100.0	100.0	100.0	100.0	100.0
Age					
Under 25	19.5	26.0	25.5	24.4	24.1
25 - 29	34.7	33.2	36.0	34.4	33.3
30 - 34	17.5	16.7	19.4	21.2	21.0
35 - 39	7.7	7.8	8.0	9.7	10.5
40 - 44	4.4	4.2	3.9	4.8	5.1
45 and above	5.5	4.6	4.1	4.7	4.7
Unknown	10.7	7.6	3.0	0.8	1.3
TOTAL	100.0	100.0	100.0	100.0	100.0
Race/Ethnic Status					
American Indian/Alaskan	1.0	1.0	1.1	1.1	1.1
Hawaiian	--	0.1	0.1	0.2	0.2
Asian/Pacific Islander	3.1	6.8	8.2	7.4	8.2
Black	6.9	7.2	7.7	6.5	7.5
Hispanic	1.5	6.2	4.2	4.9	3.1
White	76.5	75.1	75.7	77.4	77.0
Unknown	11.0	3.6	3.0	2.5	2.9
TOTAL	100.0	100.0	100.0	100.0	100.0
Nationality					
U. S.	87.1	89.9	90.0	89.8	89.2
Foreign	10.3	9.7	9.7	9.8	9.9
Unknown	2.6	0.4	0.3	0.4	0.8
TOTAL	100.0	100.0	100.0	100.0	100.0

SOURCE: ASPH Data Collection Center

1/ Only U.S. students are cross-tabulated by sex, age, and race.

Student characteristics tabulated by state or country of origin are tedious and likely of little value. However, for the record it is interesting to note the current distribution of students according to geographical origin and this is done in Appendix I. The wide variations in state of residence of students are evident in this table, though without information on the actual distribution of graduate public health personnel according to state, no conclusions can be drawn about the adequacy of manpower distribution nationally.

Prior Training and Experience. New students are asked to characterize their prior training and health work experience according to three major variables, viz, academic degree(s) earned, work experience according to whether it was health-related or not, and professional area of specialization.[1] Table 10 presents the distributions of new students by these variables and the major findings are briefly summarized below.

-Almost 25% of recent new students have a prior masters degree and at least 15% already have a doctorate, including about 11% with either a medical or dental degree. Most of these latter two categories are likely pursuing a masters degree. The distribution according to prior degree(s) earned seems to be holding stable.

-An impressive 50+% of the new students have had prior health-related work experience though the intensity, relevance, and for the most part, duration of this experience is not known. Starting in 1977-1978 a question was included in the annual student survey on the duration of the work experience and according to tabulations made for the 1977-1979 period, the following distributions were found for students reporting prior health-related work: 0-6 months - about 20%; 7 months to 3 1/2 years - about 31%; over 3 1/2 years - about 25%; unknown or not applicable - about 22%. It will be important to monitor the degree to which this distribution changes in the future as a result of recent legislation which allocates traineeships preferentially to those with prior health-related job experience and pursuing a priority area of specialization.

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[1] This variable includes persons with specialized training alone, with a work experience alone, and with both. Since there are no measures of level or intensity of involvement for the questions on specialization and work experience, one must be cautious about interpretating the responses.

Table 10. Prior Training and Work Experience of New Public Health Students, 1974-1979

Prior Training and Work Experience	ACADEMIC YEAR (BY PERCENTAGES)				
	1974-75 (N=2980) 1/	1975-76 (N=2708)	1976-77 (N=3317)	1977-78 (N=3427)	1978-79 (N=3735)
Prior Degree(s) 2/					
No Degree	*	1.5	1.5	1.2	1.2
Bachelors	*	88.4	85.7	84.5	83.9
School of Public Health Masters	*	3.4	6.6	7.2	8.0
Other Masters	*	14.5	16.4	16.9	16.4
M.D.	*	10.6	10.2	10.7	10.5
D.D.S.	*	1.2	1.3	1.2	1.5
Other Doctorate	*	3.7	3.8	4.1	4.2
Other Degree	*	3.8	3.4	9.9 3/	9.8 3/
Unknown	*	0.1	0.2	0.1	0.3
Work Experience					
Health-Related Experience	*	*	53.6	52.1	54.4
Other Work Experience	*	*	*	28.9	28.8
Prior Specialization in:					
Health Sciences	23.9	22.4	27.8	29.1	31.8
Dentistry	(1.3)	(1.0)	(1.5)	(1.2)	(1.6)
Medicine	(8.5)	(8.7)	(10.1)	(10.7)	(10.1)
Nursing	(9.8)	(7.6)	(9.1)	(9.8)	(11.7)
Other Health Sciences	(4.3)	(5.1)	(7.1)	(7.4)	(8.4)
Biological Sciences	3.7	6.4	10.2	10.2	10.9
Math/Statistical Sciences	1.8	1.2	2.8	2.2	2.3
Chemical Sciences	0.9	1.6	2.0	2.0	2.4
Data System Sciences	0.2	1.4	1.5	1.6	1.2
Physical Sciences	0.8	0.5	0.6	0.5	0.4
Social/Behavioral Sciences	3.1	3.3	6.6	7.5	6.2
Environmental Sciences	4.3	4.2	4.7	4.4	4.0
Administration and Planning	5.9	8.1	8.0	7.4	7.8
Education/Health Education	5.4	6.7	6.4	7.1	5.7
Other	23.4	43.2	27.2	26.2	24.7
Unknown	26.6 4/	1.0	2.2	1.8	2.5

SOURCE: ASPH Data Collection Center.

1/ Data for 1974-1975 were provided by the schools on an aggregate basis and hence some of the tabulations are not available for that year.

2/ Totals do not equal 100% since students may have more than one degree.

3/ Nursing degrees were specifically requested during 1977-78 and 1978-79. All respondents indicating a nursing degree were included in "other" degrees.

4/ Includes total new U.S. enrollees of three schools.

-Almost one-third of all new students now report prior specialization in the health sciences, with medicine and nursing together accounting for two-thirds of this group. Although the percentage of persons with a health background is far below that observed in the early 1960s, total enrollments are much greater and the number of professionals is not that different.

It is tempting to compare the flows of applicants according to area of specialization with those of new students according to both area of prior specialization as well as specialty area of study. The statistical basis for such comparisons is weak since on the one hand there is no way of converting applications into applicants[1/] and on the other, there is no clear correspondence between the categories used to characterize pre-school and intra-school areas of specialization. Subject to these caveats the reader may nevertheless find it of interest to compare the distribution of applications by area of specialization (Table 2) with that of entering students as shown in Table 10.

For the second comparison -- student prior specialization versus current studies -- no cross-tabulations have been prepared of these variables and hence firm conclusions cannot be drawn. Even so, the below comparisons are intriguing and suggest that a high proportion of new students enter specialty disciplines in which they already have relevant training and/or experience. The abbreviated listing in Figure 2 suggests how such a comparison might look.

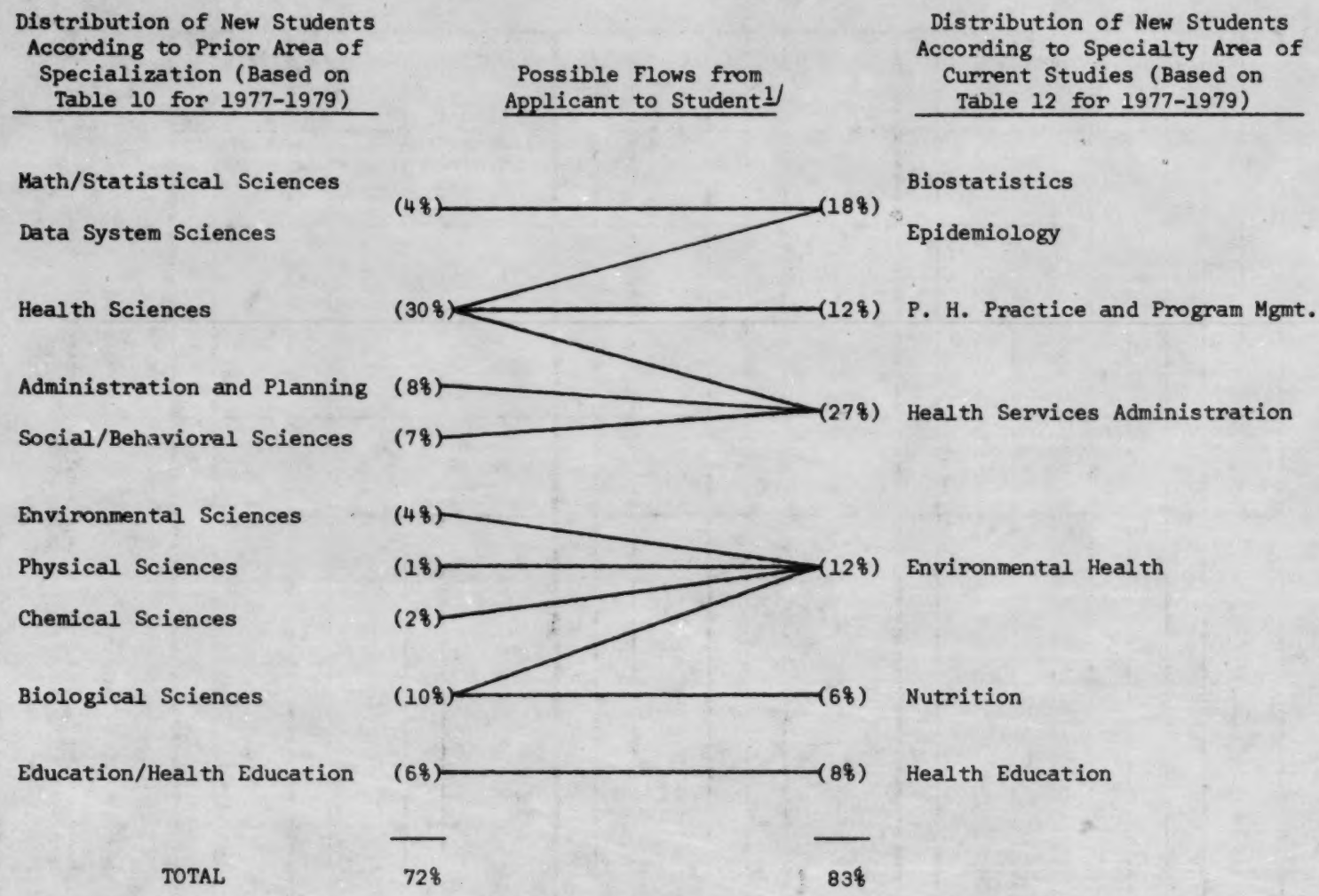
Current Study Programs. Table 11 shows the distribution of new students according to the degree program in which they are enrolled. The main findings can be summarized briefly:

-Those enrolled in a baccalaureate program still represent only a small minority of all students, and those in doctorate programs continue to account for about 10% of the total;

-The distributions by degree program are quite similar for males and females except for a slightly higher proportion of males enrolled in doctoral programs. The distributions by race/ethnic status show that about 12% of entering white students are enrolled in doctoral programs as compared with 9% for blacks and other minorities.

1/ In the section on applicants it was noted that schools provide aggregate data on applications, not applicants. Since it is almost certain that the applications/applicant ratio varies according to professional background as well as other characteristics such as age, sex, and race, it is not possible to use a single conversion factor to convert applications into applicants across all specialty categories.

Figure 2. Possible Flows of Applicants to Enrolled Students According to Area of Specialization, 1977-1979



1/ This figure suggests routes followed by applicants of defined backgrounds into analagous areas of study specialization. No data exist which could in fact establish either the magnitude or direction of the flows.

Table 11. Current Degree Program of New Students According to Selected Characteristics, 1974-1979

New Students' Degree Program	ACADEMIC YEAR (BY PERCENTAGES)				
	1974-75[1] (N=2980)	1975-76 (N=2708)	1976-77 (N=3317)	1977-78 (N=3427)	1978-79 (N=3735)
Bachelors	1.8	1.5	1.4	1.1	0.7
MPH	56.3	59.3	55.9	57.0	55.4
Other Masters[2]	15.6	26.9	27.5	27.3	27.9
DrPH	2.8	2.2	3.3	3.6	4.1
Other Doctorate	4.5	3.9	6.9	7.3	7.3
Non-Degree and Other	5.4	6.0	4.5	3.1	3.3
Unknown	13.6	0.2	0.3	0.6	1.3
TOTAL	100.	100.	100.	100.	100.
By Sex[3]					
Male					
Bachelors	*	0.9	0.9	0.4	0
Masters	*	85.6	82.4	82.3	81.9
Doctorate	*	6.6	11.0	12.9	13.3
Female					
Bachelors	*	2.0	2.0	1.5	1.2
Masters	*	86.7	84.3	86.0	84.4
Doctorate	*	5.7	9.5	9.1	9.9
By Race/Ethnic Status[3]					
White					
Bachelors/Masters	*	87.1	83.4	84.6	83.4
Doctorate	*	6.5	11.5	11.7	12.0
Black					
Bachelors/Masters	*	87.4	88.5	86.3	88.7
Doctorate	*	4.5	5.6	8.7	9.1
Other					
Bachelors/Masters	*	90.0	90.1	89.4	86.1
Doctorate	*	5.3	6.4	8.1	9.3

SOURCE: ASPH Data Collection Center.

1/ Total represents all new enrollees, including 59 of unknown citizenship.

2/ The MSPH accounts for almost 40% of the "other masters" category. This category also includes a small number of joint MD/MPH degree program students who account for about 5% of the "other masters."

3/ Totals do not add to 100 percent since non-degree programs and unknowns are excluded.

The ASPH collects information on at least 19 different specialized study programs and, as was noted in the introduction, these have recently been consolidated into nine areas plus the category "other". Table 12 shows the new student distribution according to both the full and abbreviated specialty lists and relates enrollments in the various specialty areas with prior health-related work experience. While the full list will be of considerable interest to the sub-specialties, changes observed from year to year should be interpreted with great caution due to the near certainty that some respondents answered on the basis of study track while others did so on the basis of parent or departmental discipline. For example, in some schools "population studies" will have departmental status and students would appropriately indicate this as their area of specialization, while in other "population studies" would likely represent a track within a department of biostatistics or epidemiology and such students could legitimately record either the track "population" or the parent discipline. Distributional changes observed on the abbreviated list of nine specialties will probably represent a much more accurate indicator of shifts among the specialties.

The main findings from Table 12 and other sources not presented here include:

- The distribution according to study specialty appears to be quite stable, a finding further substantiated by data presented in the next section.

- Division of the shorter list into predominantly laboratory-based specialties and predominantly field-based specialties suggests that students entering the former group are less apt to have had prior health-related work experience than those entering the latter group. For example, almost two-thirds of those enrolled in "health services administration" and in "public health practice and program management" have had prior experience, while only about one-third of those entering biostatistics or environmental health are experienced. The proportion with prior health-related experience appears to be rising based on only three years of observation.

- The unexceptional finding that higher proportions of males are enrolled in environmental health and hospital administration while higher proportions of females are in nutrition and nursing.

- Blacks are much more apt to enroll in health administration and health education than are whites, and the distribution of other large minorities is generally similar to that for whites. The relatively lower enrollment of blacks in the science-based specialties is probably in part a reflection of the lesser emphasis given to science by blacks during their undergraduate studies.

Table 12. Area of Study Specialization of New Students According to Selected Characteristics, 1974-1979

Entering Students' Area of Study Specialization (Detailed List of Specialties)	ACADEMIC YEAR (BY PERCENTAGE)				
	1974-75 (N=2980)	1975-76 (N=2708)	1976-77 (N=3317)	1977-78 (N=3427)	1978-79 (N=3735)
Health Services Administration	23.2	34.1	29.5	26.0	25.8
Health Administration	(23.2)	(31.7)	(18.4)	(15.7)	(16.3)
Health Planning	*	*	(5.7)	(5.9)	(6.1)
Hospital Administration	*	(2.4)	(5.4)	(4.4)	(3.3)
Public Health Practice and Program Mgmt.	12.0	9.4	11.2	12.7	12.2
Maternal and Child Health	(4.3)	(4.0)	(6.0)	(5.3)	(6.1)
Public Health Nursing	(4.8)	(3.0)	(2.4)	(2.6)	(3.0)
Mental Health	(1.7)	(1.4)	(1.6)	(3.1)	(1.6)
Dental Public Health	(1.2)	(0.7)	(0.9)	(1.0)	(1.1)
Gerontology	*	(0.3)	(0.3)	(0.7)	(0.4)
Epidemiology	9.1	14.2	14.3	12.5	11.9
Environmental Health	10.9	9.8	11.6	11.0	11.4
Health Education	6.5	6.4	7.8	6.8	7.3
Biostatistics	5.2	5.0	5.9	4.7	5.4
Nutrition	5.4	4.3	5.8	6.5	5.5
Biomedical Laboratory Sciences	*	*	*	3.3	3.0
Occupational Safety and Health	1.4	2.7	2.8	3.9	4.4
Other and Multiple Specialties	5.5	6.4	8.3	9.9	9.1
Behavioral and Social Sciences	(1.2)	(1.1)	(3.1)	(3.1)	(2.5)
Population Studies	(4.3)	(5.3)	(4.1)	(3.9)	(2.2)
International Health	*	*	(1.1)	(2.9)	(4.3)
Unknown/Other	20.8	7.7	2.8	6.0	7.0
TOTAL	100.	100.	100.	100.	100.
Percent of Students in Each Specialty with Prior Health-Related Work Experience (Short List)					
Health Services Administration	*	*	64.4	62.6	65.6
Public Health Practice and Program Mgmt.	*	*	76.5	75.3	76.9
Epidemiology	*	*	46.7	62.6	58.6
Environmental Health	*	*	38.2	38.6	40.1
Health Education	*	*	51.5	54.7	65.4
Biostatistics	*	*	30.3	35.3	36.1
Nutrition	*	*	39.7	38.9	52.5
Biomedical Laboratory Sciences	*	*	*	52.2	51.8
Occupational Safety and Health	*	*	44.1	54.1	50.3
Other and Multiple Specialties	*	*	50.7	56.3	64.2
AVERAGE	*	*	49.1	53.2	56.6

SOURCE: ASPH Data Collection Center.

Financial Support

The distribution of new students according to method of paying educational costs is shown in Table 13. On the average each student listed 1.8 different sources of support. As expected, traineeships are in first place, with over half of the students receiving this support. Almost one-third of the students have either full-time or part-time employment, and loans, savings, and family are other important sources of support. Most of the comparisons of sources of support by sex or race/ethnic status show minimal differences except for the higher proportion of blacks receiving traineeships and the much lower proportion of blacks receiving support from family or savings than do whites.

Student distribution by source of support was compared for new and total enrollments. For the most part the distributions were quite similar except for the finding that new students tended to depend a bit more on work and less on loans, savings, and family than did all the students taken together.

It is of interest to compare the present situation with that reported for earlier years in both the Troupin and Johns Hopkins Studies, a comparison which is unfortunately hampered by significant differences in the three data sets[1]. Several findings emerge. First, the proportion of students receiving at least "some external support" (i.e., from other than self, spouse, family, or loans) remains high. According to Dr. Troupin's data almost 60% of the graduates in the 1960s reported receiving traineeships, about the same proportion as was observed for new students in the last three years of the 1970s. About 20% of the earlier graduates were self-sponsored, probably less than was the situation in the late 1970s.

More important than the proportion receiving external support is the significance this support represents for those receiving it. The Hopkins Study has useful information on this point, regrettably unmatched by comparable data for the 1970s. Relevant findings from the Hopkins Study are summarized below:

SOURCE OF SUPPORT	TUITION AND FEES		LIVING EXPENSES	
	Percent of Graduates Receiving Support	Percent of Recipients who Covered 75%+ of Cost from this Source	Percent of Graduates Receiving Support	Percent of Recipients who Covered 75%+ of Cost from this Source
Self	19.9	45.7	48.1	34.6
Family/Relatives	4.9	37.0	17.7	20.5
Schools of P.H.	41.9	87.5	36.6	46.3
Employer	9.4	87.1	10.8	72.0
U.S. Government	28.1	87.9	27.4	57.5
State/Local Gov.	7.1	76.8	6.4	62.1
Loans	3.8	22.8	7.9	6.2
Other Sources	3.3	62.8	5.0	41.2
TOTAL[1]	118.4		159.9	

SOURCE: White, P.E., et al., Op Cit, Tables III.6, III.7, III.8, (pp. 52, 54-55).

[1] Totals add to more than 100 percent due to multiple sources of support.

[1] The Troupin and Hopkins data sets refer to graduates while the ASPH data refers to students; the Troupin data covers the 1960s and the Hopkins data covers graduates 1956 through 1972; the Hopkins data disaggregates educational costs into two categories, "tuition and fees" and "living expenses", while the Troupin and ASPH data presumably encompasses both categories; and minor differences exist among the three data sets as to the source of support categories used.

Table 13. Method of Paying Educational Costs by New Students According to Selected Characteristics, 1976-1979

Method of Paying Educational Cost	ACADEMIC YEAR (BY PERCENTAGES)		
	1976-77 (N=3317)	1977-78 (N=3427)	1978-79 (N=3735)
Detailed List[1]			
Traineeships	53.3	57.6	61.1
Employer Subsidy	9.2	12.5	10.7
Veterans Benefits	4.0	4.1	3.3
Full-time Work	9.3	8.6	9.7
Part-time Work	22.0	23.2	23.6
Loans	18.2	21.4	23.1
Family	28.1	28.8	25.0
Savings	38.3	40.6	40.0
Unknown	1.3	1.6	5.7
Short List[2]			
Traineeships			
Males	54.1	60.8	63.8
Females	54.2	56.3	65.6
Whites	51.2	57.4	64.2
Blacks	67.8	70.4	71.3
Work (Full-time/Part-time)			
Males	31.5	31.0	32.8
Females	31.9	33.8	37.6
Whites	34.1	34.8	37.5
Blacks	31.8	19.7	29.0
Loans			
Males	16.7	19.3	20.7
Females	20.3	24.1	27.7
Whites	19.1	22.4	25.6
Blacks	19.9	28.8	27.0
Family			
Males	24.7	23.7	22.3
Females	32.3	34.6	30.2
Whites	30.8	30.8	27.5
Blacks	14.6	15.5	18.3
Savings			
Males	37.7	39.8	40.1
Females	39.9	42.6	43.5
Whites	43.6	45.2	46.2
Blacks	19.5	19.7	21.3

SOURCE: ASPH Data Collection Center

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1/ Totals will add up to more than 100 percent due to multiple sources of support.

2/ Respondents with unknown methods of payment are omitted in calculating percentages.

From the figures on page 29 it is evident that external support was provided to the great majority of respondents and for most of them, this support covered the bulk of their expenses, especially as regards the category "tuition and fees". The Hopkins Study asked an additional question, viz, "Would you have attended a School of Public Health if you had not received support from sources other than self, family, or loans?", to which about 60% responded "no". This response was virtually the same irrespective of year of graduation, type of public health degree earned, racial or ethnic status, area of specialization, or age at the time of graduation, and the number of undecided or unknown responses was very low. One can therefore conclude that unless until the early 1970s, the availability of external support was a very important[1], if not determining factor, in the matriculation decision of two-thirds of those who studied public health.

There is good -- albeit currently unprovable -- reason to believe that the availability of external support is of considerably less significance today than was the case in earlier years. This conclusion is based on the supposition that although the percentage of students receiving external support remains high, this support in fact now covers a much smaller portion of total student educational cost than occurred in the 1960s. Over the past several decades federal and state funds available for traineeships have risen comparatively slowly while the dual forces of inflation and rapidly increasing enrollments (more schools, more students per entering class, and more years of study per degree awarded) have eroded the actual amount available per student assisted. Under these circumstances it is reasonable to expect that as the amount of support available to students declines so, too, will the importance of such support in determining either whether or not to study public health, or if so, the preferred area of specialization. Within the context of the annual ASPH Survey it is probably infeasible to measure accurately the impact of external support on the matriculation and/or specialization decision; the incentive to exaggerate the importance of such support is too great. However, by other means useful information could be obtained on this point, information which would be extremely valuable for both educational and governmental policy makers as they seek to design appropriate funding policies for the 1980s.

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[1] Subject to the caveats that the response rate of usable questionnaires was 60.7% and that questions on this topic likely elicit responses biased preferentially towards emphasizing the importance of external support.

Graduates - The Past and Present

This section provides an overview of trends relating to public health graduates during the past 50 years - a period which encompasses persons up to at least 75 years of age and hence presumably all those likely to be economically active at the present time. Since ASPH data tabulations on graduates for the period 1974-1979 are similar to those already presented on students, this section will not duplicate the entire review but will instead be limited to trends covering the full span of time for which data are available.

Production of Graduates. Trained public health manpower is the primary product of the schools of public health and this is measured by graduates. By any measure the output of graduates has increased rapidly, especially since the early 1960s. Table 14 summarizes aggregate school output by five-year cohorts of graduates since 1930 and more detailed data by year and school are provided in Appendices II and III, along with observations regarding data limitations. The average annual rate of increase in the output of graduates for the entire 50-year period is 7.9% for those with masters degrees and 4.2% for those with doctorates; comparable annual rates of increase for the last 20 years are 5.5% and 9.1%, respectively. These rates parallel or exceed the rate of expansion in the national pool of health manpower generally, and they would be higher still if they also included persons trained in public health specialties outside of schools of public health.

Degree Program. The doctoral degree accounted for more than a third of all degrees awarded during the 1930-1935 period but this peak rapidly declined until reaching a low of between three and four percent in the 1950s and early 1960s (see Table 14.) Since then the percentage of doctorates has steadily risen and during the latter 1970s the doctorate has come to represent almost 10% of all graduate degrees awarded.

Throughout the 50-year period the Doctor of Public Health (DrPH) degree has accounted for less than half of all doctorates awarded except for a brief ten years starting in the mid-1930s when it was the dominant degree. Since the mid-1960s the DrPH has held fairly steady at about one-third of all doctorates, with the great majority of the rest being the Doctor of Philosophy (PhD) degree. The greater familiarity with the PhD degree and the steady extension of public health into specialty areas remote from either traditional public health practice or from the clinical fields have likely contributed to the sustained popularity of this degree.

Among the masters degrees the Masters of Public Health (MPH) has become increasingly the preferred degree, steadily rising from minority status in the early 1930s to almost a 3:1 dominance in recent years. The significance of this shift is not readily apparent given the wide variety of degrees that continued to be offered in many schools. Likely here, too, as with the PhD, the greater familiarity with the MPH degree in a field otherwise replete with confusing specialty areas and degrees has tended to enhance the popularity of the MPH. Due to considerations

already noted -- declining age and experience of entering students, and the increasing complexity of the public health field -- the majority of masters degree students are now enrolled in study programs of two years' duration, in contrast to the dominant one-year program that prevailed up through most of the 1960s.

Table 14 does not record baccalaureate degrees although soon these may account for a significant portion of the total. The number of baccalaureate degrees reported in 1978-1979 amount to 69, or 2.3% of all graduates. Since the baccalaureate programs are just beginning, with stepwise expansion planned, they could perhaps attain five percent of the total graduates by the mid-1980s.

Table 14. Graduate Degrees Awarded by Schools of Public Health by Type of Degree and Five-Year Cohorts of Graduates, 1930-1980.

Period	TYPE OF DEGREE		Doctorates as Percent of Masters and Doctorates
	Masters	Doctorate	
1930-1935	283	153	35.1
1935-1940	746	98	11.6
1940-1945	1,053	96	8.4
1945-1950	2,811	102	3.5
1950-1955	(3,478)	(130)	(3.6)
1955-1960	(3,493)	(157)	(4.3)
1960-1965	4,352	211	4.6
1965-1970	6,588	505	7.1
1970-1975	9,472	880	8.5
1975-1980	(12,699)	(1206)	(8.7)
TOTAL	44,975	3538	7.3

SOURCE: See detailed footnotes to Appendix II for sources and limitations of the data. The values given in parentheses include one or more years for which estimates were made of the number of graduates: for the years 1953-1954 through 1958-1959 interpolations were made; for the period 1975-1980 the last year is an estimate and assumes the same number of graduates as for 1978-1979. The 1960s include graduates from the two Canadian schools.

Sex. As shown below, there has been a steady trend towards equalizing the sex ratio of public health graduates ever since disaggregated data by sex first became available in the 1960s.

Period	Male	Female
1960-1965	3392	1171
1965-1970	4728	2365
1970-1975	6427	4079
1975-1979	5889	5567

Starting with a 3:1 male/female ratio at the start of the 1960s, the ratio declined to 2:1 by the end of that decade and only a few years later in 1978-1979, women graduates first outnumbered men (see Appendices II and IV for details). This trend may even continue a bit more before stabilizing, possibly with a ratio close to three women graduates for every two men. The reasons why this might occur are several:

(1) Schools of public health won't or can't reverse the current trend towards accepting into their entering classes a high percentage of persons without prior health-related training or experience. If more training and experience were required this would probably favor, at least for a while longer, men; otherwise it favors women students.

(2) The predominantly female public health specialties (e.g., public health nursing, health education) are experiencing declining or at least stable enrollments while the predominantly male specialties (e.g., environmental sciences) are still growing and, for the most part, are still filled with men. As a result there remains considerable potential for a change when and if more women become interested in these latter fields.

(3) The health sector, and especially the governmental portion of it, will likely continue to provide relatively favorable employment opportunities to women compared with those available elsewhere and hence attract many women applicants.

(4) The long observed phenomenon that women average somewhat higher college grade point averages and GRE scores than do men is likely true for many of the public health specialties as well and if so, this could provide them with a slight competitive advantage in the admissions process.

Nationality. The proportion of foreign graduates has declined slightly during the 1970s from an average of 14% during the first half of the decade to about 12% during the last five years[1]. Although reliable data on nationality are not available prior to 1970, very likely the percentage was at least 14% and perhaps somewhat higher during the 1960s. During these years the World Health Organization, U.S. foundations, and the U.S. foreign assistance program all provided numerous traineeships for graduate training in public health.

The distributions of U.S. and foreign graduates according to type of degree earned are quite similar, with the slightly higher proportion of U.S. graduates receiving the baccalaureate degree being expected. During the five-year period 1974-1979, the distributions were as follows (based on Appendix IV):

Nationality	Bachelors	Masters	Doctorate[1]
U.S. Graduates	3.2%[2]	88.8%	8.0%
Foreign Graduates	0.8%	89.1%	10.1%

[1] Post-doctorates, special students, and others not included.

[2] During 1975-1976, 31.3% (46) of the gradautes at Puerto Rico were bachelors. The large number of bachelors degrees produced an abnormally high percentage of bachelors degrees (4.5%) that year. This is the last year Puerto Rico reported bachelors degree graduates.

Age. The ASPH Data Collection Center has not tabulated the age of graduates during the 1970s and indeed with the abundance of information already available on applicant and student ages, comparable data on graduates would add little. The age distributions shown below of graduates for three years in the 1960s confirm once again the rapid decline that has occurred in the average age of those studying public health.

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[1] This percentage is higher than that recorded for foreign students (about 10%, per Table 9). The reason for this difference may be due in part to the fact that a larger percentage of U.S. students enrolled as part-time students and the data for graduates include some who, as students, were holders of U.S. immigrant visas and hence were counted as U.S. students.

Age Range	PERCENTAGES IN EACH AGE GROUP		
	1960-1961	1965-1966	1969-1970
Under 25	3.2	5.7	9.0
25 - 29	21.3	23.3	28.1
30 - 34	27.9	25.1	24.9
35 - 39	22.9	17.7	15.5
40 - 44	14.2	15.6	10.2
45 and over	11.3	12.5	12.3

SOURCE: Based on reports by Dr. James Troupin

Race/Ethnic Status. The distribution by racial or ethnic classification has been remarkably, and perhaps discouragingly, stable over the five years of data collection by the ASPH. Data on race/ethnic graduates are based on U.S. citizens only. During a period of intensive efforts to increase the representation of minorities the percentage of black graduates has actually declined from 9% of the total in 1974-1976 to 6% and 6.2%, respectively, in the last two years of the decade. The percentages of other minorities have remained quite stable at the following levels: Asians and Pacific Islanders - 4.4%; Hispanics - 3.6%; American Indians and Alaskan Natives - 0.9%; and Hawaiians - 0.2%. (See Appendix IV for details.) Since most of the minority categories are small, only minor differential omissions in the recording of gradautes by racial or ethnic status can distort the results considerably. A more sensitive data source for tracking changes in racial and ethnic status will likely prove to be student data; most student data are provided by the students themselves and in recent years the omission of racial/ethnic data in the student tabulations has been three percent or less. It should be noted, however, that changes in student characteristics will precede by one to three years (depending on the degree program) changes in graduate characteristics and due to the possibility of differential academic retention rates by racial or ethnic status, the changes may not move precisely in parallel.

Area of Specialization. The most notable finding evident in Table 15 is that the distribution of graduates by area of specialization has changed so little over at least the last 18 years since data on this variable have been collected. There are, to be true, some abrupt and unexpected ups and downs in the percentages but these are much more the exception than the rule and for the most part give the impression of being artifacts, the likely result of changing definitions and interpretations regarding specialty classification.

The questions as to why this stability -- in the face of two decades of rapid change in both school enrollments and in the health sector -- is both important and difficult. Several very different explanatory hypotheses can be put forth, though regrettably available information is insufficient to provide answers. These hypotheses, by no means mutually exclusive, include:

- -The relative demand by the health sector for the different types of public health specialists has not changed significantly over the last two decades and the schools of public health have continued to respond appropriately to that demand;

- -Health sector demand for the different public health specialists does not match school of public health production but intra-school rigidities[1] and/or lack of appropriate feedback mechanisms have kept the schools from responding to market needs in a timely fashion;

- -Sectoral demand and school production do not match but the differential rates of growth of the public health specialty training programs outside of schools of public health have (1) shielded the schools from pressures for change and/or (2) have compensated for school inability or reluctance to change;

- -For at least some of the specialties it doesn't make much difference whether school production matches market demand since graduates are able to move relatively freely between specialties as their career interests and market needs change;

- -The concept of classification by specialty isn't a very useful means of differentiating students and graduates according to study program, i.e., departmental titles, programs, and enrollments have been fairly constant for historical reasons even though educational program content changed substantially in response to perceived market needs.

Probably all of these hypotheses have at least some validity but the relative importance of each will have to remain in the realm of speculation until quite different data become available. Examples of information which could be useful include: the relative speed with which graduates of each specialty find jobs and their pace of career advancement; career stability of each specialty over time; the differential rates of growth of the various specialties for which much of the training occurs outside of schools of public health; and some understanding of the evolution of curricular content and the process of curricular change over time.

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[1] Examples of such rigities could include (1) the inability to change departmental budgets promptly in response to emerging manpower needs or (2) a tendency for departmental enrollments to be determined more by student preferences than by market demand.

Table 15. Graduate Degrees Awarded by Schools of Public Health by Area of Specialization, Selected Years, 1961-1962 to 1978-1979

AREA OF SPECIALIZATION	PERCENTAGE DISTRIBUTION BY YEAR								
	1961-62 (N=802)	1966-67 (N=1169)	1971-72 (N=1955)	1974-75 (N=2337)	1975-76 (N=2945)	1976-77 (N=2775)	1977-78 (N=2829)	1978-79 (N=2917)	1974-79 (N=13,803)
Biomedical and Laboratory Sciences	4.1	5.7	3.1	0.8	2.5	2.2	3.1	3.1	2.3
Biostatistics	4.6	5.1	5.2	5.5	4.8	5.3	5.6	4.7	5.2
Environmental Sciences	13.0	10.8	15.2	11.7	12.8	13.4	14.9	15.3	13.6
Epidemiology	13.1	11.0	6.2	9.9	9.1	10.5	11.1	12.2	10.6
Health Education	9.3	10.7	7.9	4.3	7.7	6.5	6.4	6.1	6.2
Health Services Administration	30.1	24.8	30.0	27.3	32.0	29.3	26.1	26.0	28.1
Nutrition	3.5	6.3	3.0	5.2	4.9	4.7	4.9	5.6	5.1
Occupational Safety and Health	6.2	5.7	0.1	1.1	1.5	0.8	0.7	0.7	1.0
Public Health Practice and Prog. Mgmt.[1]	15.3	16.7	13.9	11.1	13.2	10.8	10.6	9.6	11.1
Maternal and Child Health	(4.9)	(6.7)	*	(4.2)	(5.0)	(5.7)	(5.2)	(4.6)	(4.9)
Public Health Nursing	(6.1)	(6.3)	*	(3.3)	(5.3)	(2.9)	(3.1)	(2.3)	(3.4)
Other[2]	0.8	3.2	15.4	23.1	11.5	16.4	16.6	16.7	16.9
International Health	*	(1.5)	*	(1.1)	(1.3)	(2.0)	(2.2)	(2.3)	(1.8)
Population Studies	*	*	*	(4.8)	(4.7)	(5.8)	(4.6)	(4.8)	(4.9)
TOTAL PERCENTAGE	100.	100.	100.	100.	100.	100.	100.	100.	100.

SOURCE: ASPH Data Collection Center and reports prepared by Dr. James Troupin. Changing terminology over time and problems of fitting school programs and titles into the categories offered by the data collection systems will limit somewhat the validity of this table.

[1] Total includes Maternal and Child Health and Nursing.

[2] Total includes International Health and Population Studies.

As a start on this point, it is interesting to speculate on (1) the validity of recent government perceptions that certain specialties are in particularly short supply, and (2) whether the ensuing legislation that gave priority funding to students enrolled in these areas has any chance of modifying the production of public health graduates according to area of specialization. Given the limited changes that have occurred over the past 18 years of rapid growth, expectations should probably not be high.

As a brief addendum to this section it is interesting to note the specialty distribution of graduates for 1978-1979 according to nationality. The difference between American and foreign graduates is much as one would expect and for the latter group appears consistent with the needs of developing countries.

Short List of Specialty Areas for Graduates of the Class of 1978-1979

Specialty Area	U.S. N=2609	Specialty Area	Foreign N=308
Health Administration	27.2	Epidemiology	19.8
Environmental Health	15.9	Other	19.5
Other	15.7	Health Administration	16.6
Epidemiology	11.3	P.H. Practice/Program Mgmt.	13.0
P.H. Practice/Program Mgmt.	9.9	Environmental Health	10.4
Public Health Education	6.4	Biostatistics	7.5
Nutrition	5.7	Biomedical Lab. Sciences	6.2
Biostatistics	4.3	Nutrition	3.6
Biomedical Lab. Sciences	2.7	Public Health Education	3.2
Occupational Safety/Health	0.8	Occupational Safety/Health	0.3

SOURCE: ASPH Data Collection Center.

The Future

Supply projections can vary from the complex to the simple; in the absence of much of the data that would be desirable to attempt the former, the projections developed here of public health manpower will tend towards the latter. Given the lack of information on the number of school of public health graduates who are economically active in the U.S. the prudent course would be to limit projections to the number of new graduates likely to be produced in the next few years. This section will provide these estimates but will also attempt to go considerably further to the point of estimating the current and future supplies of economically active school of public health graduates at five-year intervals until the year 2000. Some

limited disaggregation will be made by area of specialization though here the perils of specious precision are especially great. Major assumptions used in these projections are outlined below in general terms and the specifics are detailed in the footnotes to Table 16. Those with alternative assumptions regarding losses or increments, or who wish to test the impact of specific policies affecting supply, can readily modify the model to suit their own needs.

(1) Present supply is based on the past production of graduates corrected downwards for (a) Canadian graduates, (b) other foreign nationals, (c) attrition over time, and (d) a factor to minimize the risk of double counting persons who received two or more degrees from schools of public health. This latter factor recognizes that a significant but unknown number of baccalaureate/masters graduates subsequently obtain a higher degree from a school of public health and if no correction were made for this reality, the number of degrees awarded over a period of time would in fact exceed the number of different individuals trained to work in public health. Accordingly, the number of doctorate degrees is accepted as given (i.e., the doctorate is regarded as a terminal degree) while the number of baccalaureate/masters degrees is reduced by 7% on the assumption that approximately that percentage subsequently go on to earn higher degrees, along with an additional smaller number with masters degrees earned from other than a school of public health.

(2) Loss estimates are developed by applying assumed rates of attrition for each five-year cohort of graduates over time. These rates, expressed as rates of retention in active service, are based on the following assumptions: an age at graduation of about 25 years; a pattern of attrition that corresponds to that observed for predominantly male professions[1], negligible losses for reasons other than death and illness (i.e., no losses due to emigration, change of occupation, or early retirement for other than health reasons); no changes in the loss rates over time; similar loss rates for all specialties and types of degrees; and that each cohort ceases remunerated employment in the public health field once its youngest members are 40 years post-graduation (i.e., have attained an average age of 65). Applied to 100

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[1] Attrition rates for predominantly female professions such as nursing are much higher than for prodominantly male professions such as medicine. While this was probably also the case in public health for persons graduated in the 1960s and earlier, the differential is probably decreasing rapidly, a trend whose effects may be countered to some degree by the rising proportion of women graduates. Once again, in the absence of more refined data it does not seem useful to postulate different rates of attrition for males and females, but only to note the possible consequences of this factor.

graduates of the five-year period, 1935-1940 (i.e., the classes of 1935-1936 through 1939-1940), the assumed attrition rates would result in the following numbers of persons economically active in public health work in the stated years[1]:

100 Graduates, 1935-1940

99 active in 1940	81 active in 1965
97 active in 1945	73 active in 1970
95 active in 1950	61 active in 1975
91 active in 1955	37 active in 1980
86 active in 1960	0 active in 1985

In the aggregate these supply estimates will more likely be high than low and will vary for different specialties. Nevertheless, given the rather uncertain data on the production of graduates in the past, and even more importantly, the lack of any reliable estimates for variable-specific (age, sex, specialty, etc.) retention rates in public health work over time, it would be unrealistic to attempt further refinements in the model at this time.

(3) Increment estimates assume continuation of the annual rate of production observed during the 1977-1979 period, corrected downwards for foreign graduates and to avoid double counting of those receiving two or more degrees from schools of public health.

Projections. The results of the supply model, applied to all graduates without differentiation according to area of specialization, are presented in Table 16. Calculations were made throughout without rounding, though it must be emphasized that the resultant projections should be rounded to at least the nearest one thousand and in fact are probably accurate[2] only to within plus or minus 10%. A brief summary is given below on their implications and on the main sources of potential error.

(1) Numerical supply. The supply of active school of public health graduates working in the United States is expected to double from almost 36,000 in 1980 to 72,000 by the end of the century. This assumes continuation of the present rate of training by the 21 schools of public health now in the ASPH data collection system.

1/ See Health Manpower Planning: Principles, Methods and Issues, T. L. Hall and A. Mejia, editors, World Health Organization, Geneva, 1978, pp. 104-106, for a discussion of this method in estimating losses in the absence of detailed information on professional worklife expectancy.

2/ This "accuracy" is predicated on the key assumption of a constant rate of production of new graduates similar to that observed in the last two years of the 1970s.

(2) Rate of increase. The average annual cumulative rate of increase in the supply of active public health graduates is 5.3% for the period 1980-1985, 3.9% for 1985-1990, 2.9% for 1990-1995, and 2.3% for 1995-2000.

(3) Numbers of degrees and graduates. From 1935 through mid-1980 the schools of public health will have awarded approximately 44,893 bachelors and masters degrees and 3,452 doctorates, or 48,345 degrees in all. About 38,811 (80%) of these degrees will have been awarded to different individuals who are either U.S. citizens or, in more recent years, holders of U.S. immigrant visas.

(4) Percent employed. In 1980 an estimated 91.4% of all U.S. graduates 45 years or less since graduation either will or could be actively employed in public health. The percentages remaining active will slowly drop to about 90.7% in 1985, 89.3% in 1990, 88.5% in 1995, and 87.6% in 2000. Given the assumed retention rates used in this projection model, these percentages would stabilize at about 80% once all nine of the five-year cohorts had the same number of starting graduates. In other words, if every cohort started with a postulated 1000 graduates and the total for the nine cohorts was 9000, then approximately 7200 (or 80%) would be active at any one time. The projected high but descending averages in the specific case under consideration reflect the recent and very rapid expansion in public health training, a young average age, and the assumed leveling off of future production.

Implications. What can be usefully said about the implications of these projections for manpower policy? At this point, and in the absence of meaningful information on demand or requirements[1], not much. The numbers are going up rapidly with a current rate of increase that is about five times that of population growth and is probably significantly faster than the expansion of health manpower generally. Nevertheless, even by the year 2000, graduate public health manpower would still represent only a tiny fraction of the health manpower supply. For example, school of public health graduates in 1980 will represent only about 0.6% of the total health manpower supply, a share which would grow to only one percent by the year 2000 if the total health manpower supply averaged only a slow 1.2% annual cumulative growth rate from now until the end of the century, a rate which is well below long-term historical tendencies[2]. Even if by

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[1] These are not necessarily synonymous. A given health objective may "require" a certain quantity of manpower to accomplish it even while the market "demand" for such personnel is insufficient to provide full employment. These distinctions are particularly relevant to public health manpower planning since most such personnel is employed in the public sector.

[2] Based on the estimate of about 5.1 million persons employed in the "health field" in 1976 as reported in Health Resources Statistics, 1976-1977 edition, National Center for Health Statistics, DHEW, Washington, D.C.

Table 16. Estimated Supply of Economically Active Public Health Graduates in Selected Years, 1980-2000

Five-Year Cohort of Graduates (July-June)	Number of Graduates 1/		Adjusted Number of Graduates 2/		Estimated Percentage of Cohort Active in: 3/					Estimated Number Active in: 4/				
	Masters Bachlrs	Doctors	Masters Bachlrs	Doctors	1980	1985	1990	1995	2000	1980	1985	1990	1995	2000
1935-1940	746	98	604	85	37	0	0	0	0	255	0	0	0	0
1940-1945	1,053	96	852	84	61	37	0	0	0	571	346	0	0	0
1945-1950	2,811	102	2,275	89	73	61	37	0	0	1,726	1,442	875	0	0
1950-1955 5/	3,478	130	2,814	113	81	73	61	37	0	2,371	2,137	1,785	1,083	0
1955-1960 5/	3,493	157	2,826	137	86	81	73	61	37	2,548	2,400	2,163	1,807	1,096
1960-1965	4,252	211	3,319	173	91	86	81	73	61	3,178	3,003	2,829	2,549	2,130
1965-1970	6,588	505	5,024	414	95	91	86	81	73	5,166	4,949	4,677	4,405	3,970
1970-1975	9,472	880	7,385	758	97	95	91	86	81	8,093	7,926	7,592	7,175	6,758
1975-1980	12,596	1309	10,623	1126	99	97	95	91	86	11,632	11,397	11,162	10,692	10,104
1980-1985	14,210	1400	11,379	1205	--	99	97	95	91	--	12,458	12,206	11,955	11,451
1985-1990	14,210	1400	11,379	1205	--	--	99	97	95	--	--	12,458	12,206	11,955
1990-1995	14,210	1400	11,379	1205	--	--	--	99	97	--	--	--	12,458	12,206
1995-2000	14,210	1400	11,379	1205	--	--	--	--	99	--	--	--	--	12,458
TOTAL	101,429	9088	81,438	7799						35,540	46,058	55,747	64,330	72,128

1/ Cohorts from 1935-1939 through 1975-1979 are based on Appendix II. The numbers of graduates for cohorts from 1980-1984 onwards were estimated as follows: graduates reported for the years 1977-1978 and 1978-1979 were summed and the total divided by two to obtain the annual average; the annual average was increased by an arbitrary 7% to account for (1) planned completion of full enrollments at the new schools of public health, and (2) known under-reporting (e.g., Puerto Rico) of graduates during the 1977-1979 period. Baccalaureate and masters degrees were combined in the estimates.

2/ The estimated numbers of graduates in each cohort according to type of degree were adjusted in two steps to eliminate (approximately) (1) foreign graduates likely to return to their countries of origin and Canadian graduates from the two Canadian schools in the 1960-1970 cohorts, and (2) double counting of baccalaureate and masters graduates who go on to earn a subsequent doctorate degree in a school of public health. Foreign graduates were eliminated by multiplying the unadjusted cohort totals by the following deflators: 0.861 for cohorts from the period 1970-2000 (i.e., an estimated 86.1% of all graduates during the 1970s were U.S. citizens and it is assumed that this same percentage will prevail during the balance of the century); 0.82 for cohorts from the 1960s (i.e., an estimated 82% of all graduates were U.S. citizens after deducting Canadians and other foreign graduates); 0.87 for cohorts prior to 1960 (i.e., an estimated 87% of all graduates were U.S. citizens or were foreign graduates who later elected to stay in the U.S.). Double counting was then minimized by multiplying the above resultant totals of U.S. citizens earning baccalaureate and masters degrees by 0.93 on the assumption that the remaining 7% went on to earn a doctorate at a school of public health. No further adjustments were made for doctoral graduates.

3/ Based on retention (in active employment) rates reported in the text and which assume: a predominantly male profession; an age at graduation of 25 years; no losses due to other than death, disability, and retirement as soon as each cohort reaches 66-70 years of age.

4/ Obtained by multiplying the adjusted number of graduates in a given cohort by the estimated percent assumed to be active in each target year, e.g., 0.37 times (604 + 85) = 255 bachelors/masters/doctoral graduates from the 1935-1940 cohort are assumed to be economically active in public health and in the U.S. in the year 1980.

5/ Most of the graduates in these cohorts had to be estimated by interpolation for lack of reported school output.

including those trained outside of schools of public health the rate of increase in public health manpower is double that calculated from Table 16, this category would still probably not exceed the one percent mark by the year 2000. In the absence of any data to the contrary it would be easy to argue that the health sector could afford to employ at least one graduate level public health specialist by the year 2000 to work in such areas as health services administration, environmental sciences, the measurement of health-related phenomena, and the evaluation of health activities. Against this "hunch" that the demand for public health manpower will keep up with the projected supply one must note that almost certainly health sector growth will begin to slow down and that the total output of public health graduates from all sources will be well in excess of the numbers given here. Accordingly, a growth rate for public health manpower that may be appropriate in the aggregate, may in fact be excessive, or even insufficient, in a given area of specialization.

Projections by area of specialization. If projections of the active supply of public health graduates have their limitations, these are compounded severalfold in the case of projections by area of specialization. Nevertheless, the exercise seems worthwhile in order to provide a guide as to the potential numbers of persons qualified in each of the major public health specialty areas who could be available for employment in the different target years. Projection accuracy will likely be correlated closely with the relative size of each specialty, ranging perhaps from plus or minus 60% for specialties that account for less than 5% of the total supply, through about 30% for those with up to 10% of the supply, to about 20% for those with over 10%. The main data elements required to make the projections are listed below along with the assumptions used in the model.

-Numbers of graduates by year and specialty since 1935. About 70% of all public health graduates received their degrees since 1960 and almost 50% since 1970. Information on specialties extends back to 1961 and as noted previously, the specialty distribution has shown relatively few changes through to 1979. The percentage distribution of graduates by specialty was determined for the 1960s and for the period 1974-1979. The percentages accounted for by each specialty in the two periods were then averaged, giving twice as much weight to the 1974-1979 value (since there were twice as many graduates in the 1970s and the data were more recent) than to the 1960s' value, and the resulting weighted average for the two periods was rounded to the nearest unit. These proportions were then applied to the total of all U.S. graduates (adjusted totals, Table 16), irrespective of year of graduation or of degree earned, both retrospectively back to 1935 and prospectively forward to the year 2000. In other words it was assumed that every cohort from 1935-1940 through 1995-2000 had the same distribution by specialty as did the weighted average of distributions observed in the 1960s and in the latter 1970s.

-Retention rates in active employment were assumed to remain constant throughout the 1935-2000 period as per the general projection model used, and no attempt was made to correct for the near certainty that different rates in fact apply according to specialty, degree, sex, cohort of graduation, and perhaps other variables.

-Foreign graduates. Canadian and other foreign graduates were eliminated (approximately) from the calculations per the procedures described in the footnotes to Table 16.

The resulting projections are presented in Table 17. Perhaps the most notable findings are the relatively small numbers of trained persons likely to be available by the year 2000, even in the larger specialties. By then the health sector could easily double its real cost and provide employment for more than eight million workers[1], leaving the numbers of public health specialists to border on the miniscule. For some fields such as health services administration there are many training programs outside of schools of public health but for fields such as epidemiology and biostatistics, the contribution of the schools is presumably of much greater relative importance. For these latter specialties a combined projected supply of less than 11,000 seems small. And for fields such as occupational safety and environmental sciences the likely requirements are so great that the projected contribution of the schools of public health is almost significant.

Manpower projections, policy and information. This section has developed projections to the year 2000 of persons with graduate training from schools of public health - an important but by no means an exclusive source of trained public health manpower. Partial supply projections may be interesting and can help generate important policy questions but they are without doubt apt to be very frustrating; they raise far more questions than they can answer. This section has remarked on all the data limitations regarding retention rates over time, lifetime career stability in the several specialty areas, and the degree to which data on graduates should be adjusted downwards to correct for foreign graduates and for persons earning two or more degrees. These limitations are trivial, however, compared to the uncertainties that result from the lack of consolidated data on the production and supply of graduate public health manpower from all sources. Until these important parts of the puzzle can be brought to the table, the larger picture on manpower supply will not take shape.

How can decision-making with regard to the production of public health manpower be improved if only partial study data are available and almost nothing is known about the dynamics and dimensions of demand? A major supply/demand study would be useful but for the forseeable future may well prove too costly to be feasible. Moreover, the inherent problems of

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[1] A doubling in health expenditures from the 1978 value would require an annual real growth of only about 3.2%; for the total health sector manpower to attain eight million would require a 2% annual growth.

Table 17. Projected Supply of Economically Active Public Health Graduates by Area of Specialization in Selected Years, 1980-2000

Area of Specialization	At Time of Graduation 1/ (1935-1980) Estimate of:		Estimated Number of Graduates in Specialty Who Are Economically Active				
	Percent in Specialty	Number in Specialty	1980	1985	1990	1995	2000
Biomedical and Laboratory Sciences	3	1,167	1,066	1,382	1,673	1,930	2,164
Biostatistics	5	1,945	1,777	2,303	2,787	3,216	3,606
Environmental Sciences	13	5,057	4,620	5,987	7,247	8,363	9,377
Epidemiology	10	3,890	3,554	4,606	5,575	6,433	7,213
Health Education	7	2,723	2,488	3,224	3,902	4,503	5,049
Health Services Administration	28	10,893	9,951	12,896	15,609	18,012	20,196
Nutrition	5	1,945	1,777	2,303	2,787	3,216	3,606
Occupational Safety and Health	2	778	711	921	1,115	1,287	1,443
Public Health Practice and Program Mgmt.	12	4,668	4,265	5,527	6,690	7,720	8,655
Other	15	5,835	5,331	6,909	8,362	9,650	10,819
TOTAL	100	38,901	35,540	46,058	55,747	64,330	72,128

SOURCE: Based on estimates in Table 16 and assumptions in text.

1/ Based on "adjusted numbers of graduates" given in Table 16. These adjustments eliminate (approximately) Canadian and other foreign graduates as well as the double counting that might result due to persons with two or more degrees from schools of public health.

classification, characterization, and quantification of public health manpower are likely to make the results of such an undertaking considerably less convincing than the projections that have been made for established manpower categories such as physicians and nurses, projections which it should be noted have not been remarkable for their accuracy. Several more limited measures of relatively low cost could, however, considerably improve the basis for decision-making pending that elusive day when a comprehensive manpower data system is fully operational and major planning studies have been completed. These actions are:

(1) Aggregate estimates and projections of public health manpower. Conduct a study to pull together all existing data on the past and current production of public health manpower at the baccalaureate level and higher, whether from schools of public health or elsewhere. Assemble this information so as to develop range (high/low) estimates of the numbers of persons who have received degree training, irrespective of location, in the various major public health specialty fields, by year. Adjust these estimates as seems most appropriate to each case to derive the numbers of Americans who could potentially be economically active at the present time and at defined target years in the future.

(2) Update supply estimates periodically. Monitor reported production figures of public health graduates from all sources and update production and projected supply estimates periodically.

(3) Monitor and periodically summarize the relevant literature. Review and summarize the findings of the published and unpublished literature as it pertains to public health manpower supply, demand, distributions, qualifications, training, and related topics. The bibliography presented at the end of this report, covering a 13-year period through 1978, is a first, very tentative step in this direction. The yield in the attached review is generally "weak tea", but some useful information is available on certain specialties, information that couldn't be adequately utilized within the limited context of this report. By pulling together the various pieces of information and insight that are in the available literature, valuable clues can be obtained regarding what is happening, what the problem areas are, and most importantly, what researchable questions deserve priority.

(4) Periodic survey of the demand for new graduates. Perhaps the best method of inexpensively assessing the real market demand for professional public health manpower would be by means of periodic surveys of recent graduates. The value of these surveys would be predicated on the assumption that recent graduates in any field can be considered

as the "leading edge" of the manpower supply in that field. As such, the job acquisition process of these graduates will be sensitive to subtle changes in demand long before they would become manifest to interested parties. In short, if demand is strong, new graduates will presumably find jobs quickly, working conditions will be attractive and job characteristics will be in accord with student expectations at the time of graduation; and conversely, if demand is slackening, the opposite conditions will prevail. Adequate information on these and related indicators of demand could be acquired at modest cost; a brief questionnaire every three or four years to graduates of no more than about one-third of all training institutions should suffice. Moreover, if a subsample of graduates were surveyed on a recurring panel basis at approximately five-year intervals, valuable insights could be obtained for each specialty on such topics as the rate of career advancement, career stability, relevance of training, current and likely future demand for specialists, need for continuing education, and retention in active employment. The results of surveys of recent and former graduates have current value but of even greater importance would be the ability to observe trends over time, trends which could signal the need for gradual changes in enrollments and/or training content in one or another specialty area. Since most public health training programs are considerably shorter and potentially more flexible than the traditional health professions of medicine and dentistry, an early warning system of the type proposed could allow the training institutions to introduce change in an unhurried and thoughtful manner.

Implementation of the above suggestions need not be costly. If the information so generated were combined with that produced from a simple data system to monitor the production of all types of public health manpower, those concerned with decisions regarding this important category of personnel could go a long way towards improving the bases for developing future policy and program objectives.

Appendix I. Distribution of New Public Health Students by State or Country[1/] of Origin, Fall of 1978

STATE	NUMBER OF NEW STUDENTS	STATE	NUMBER OF NEW STUDENTS	STATE	NUMBER OF NEW STUDENTS
Alabama	31	Maine	5	Oregon	21
Alaska	6	Maryland	136	Pennsylvania	171
Arizona	10	Massachusetts	199	Rhode Island	4
Arkansas	3	Michigan	214	South Carolina	50
California	515	Minnesota	145	South Dakota	5
Colorado	21	Mississippi	17	Tennessee	10
Connecticut	75	Missouri	13	Texas	185
District of Columbia	22	Montana	10	Utah	5
Florida	38	Nebraska	6	Vermont	5
Georgia	15	Nevada	4	Virginia	31
Hawaii	103	New Hampshire	10	Washington	72
Idaho	7	New Jersey	67	West Virginia	12
Illinois	107	New Mexico	17	Wisconsin	22
Indiana	6	New York	239	Wyoming	1
Iowa	5	North Carolina	167	Puerto Rico	10
Kansas	9	North Dakota	4	Other	1
Kentucky	3	Ohio	48	Not Applicable	396
Louisiana	49	Oklahoma	54	Unknown	354
COUNTRY	NUMBER OF NEW STUDENTS	COUNTRY	NUMBER OF NEW STUDENTS	COUNTRY	NUMBER OF NEW STUDENTS
Bangladesh	12	India	5	Nigeria	24
Brazil	9	Indonesia	20	Philippines	9
Canada	29	Iran	16	Republic of China	42
Ghana	11	Japan	6	Tanzania	5
Great Britain	10	Kenya	12	Thailand	24
Hong Kong	10	Korea	6	Venezuela	7

SOURCE: ASPH Data Collection Center

1/ Only those countries with five or more students in the entering class are listed. Besides the 18 foreign countries listed, an additional 38 countries contributed one to four new students each.

Appendix II. Graduate Degrees Awarded by Schools of Public Health by Type of Degree, Sex, and Nationality, 1930-1931 to 1978-1979[1]

Academic Year	MASTERS		DOCTORATE	
	MPH	Other	DrPH	Other
1930-1935	120	163	61	92
1935-1936	33	26	15	7
1936-1937	40	53	15	6
1937-1938	47	57	22	14
1938-1939	131	90	9	9
1939-1940	184	105	19	12
TOTAL	415	331	80	48
1940-1941	156	99	20	6
1941-1942	158	76	11	22
1942-1943	100	22	7	2
1943-1944	118	56	10	6
1944-1945	162	106	8	4
TOTAL	694	359	56	40
1945-1946	250	127	3	7
1946-1947	393	200	6	7
1947-1948	422	119	11	12
1948-1949	375	190	12	15
1949-1950	381	355	11	18
TOTAL	1821	991	43	59
1950-1951	458	204	9	20
1951-1952	495	237	5	16
1952-1953	463	213	10	17
1953-1954	(704)		(26)	
1954-1955	(704)		(27)	
TOTAL	(3478)		(130)	
1955-1956	(704)		(29)	
1956-1957	(705)		(30)	
1957-1958	(705)		(31)	
1958-1959	(705)		(33)	
1959-1960	535	139	14	20
TOTAL	(3893)		(157)	

Academic Year	MASTERS		DOCTORATE		ALL DEGREES			
	MPH	Other	DrPH	Other	Male	Female	U.S.	Foreign
1960-1961	562	174	20	14	(593)[2]	(177)[2]	DATA NOT AVAILABLE	
1961-1962	562	210	14	16	620	182		
1962-1963	592	229	12	18	627	224		
1963-1964	640	296	22	40	739	259		
1964-1965	786	321	18	37	813	329		
TOTAL	3122	1230	86	125	3392	1171		
1965-1966	790	337	32	49	831	377		
1966-1967	729	365	33	42	795	374		
1967-1968	819	385	30	62	893	483		
1968-1969	1051	439	34	75	1061	538		
1969-1970	1094	499	46	102	1148	593		
TOTAL	4583	2005	175	330	4728	2365		
1970-1971	1108	420	36	106	1055	593	1,418	241
1971-1972	1349	560	53	106	1310	784	1,723	350
1972-1973	1415	528	67	112	1316	801	1,885	255
1973-1974	1592	546	70	140	1438	930	2,008	345
1974-1975	1509	522	69	121	1314	1023	2,054[3]	283
TOTAL	6973	2576	295	585	6433	4111	9,088	1,474
1975-1976	1802	737	90	142	1589	1357	2,575	370
1976-1977	1704	779	82	125	1454	1321	2,480	295
1977-1978	1872	639	69	188	1416	1403	2,459	380
1978-1979	1818	741	84	205	1431	1486	2,609	308
TOTAL	7196	2896	325	640	5889	5567	10,123	1,333

SOURCES: 1930-1953, American Journal of Public Health; 1959-1970, Reports prepared by Dr. James Troupin for the American Journal of Public Health; 1970-1974, A Special Survey of the Schools of Public Health by ASPH Data Collection Center; 1974-1979, ASPH Data Collection Center Annual Reports.

1/ There are many partial omissions in the data set. Data completeness and accuracy likely fluctuate from period to period. Through 1969-1970 the data include graduates from Canadian schools of public health and for the years 1970-1975 and 1977-1978 graduates from the University of Puerto Rico are omitted. For years prior to 1974-1975 it is unclear whether the "U.S. citizens" category includes those with immigrant visas; starting with that year such persons are included as U.S. citizens. Figures in parentheses for the period 1953-1959 were estimated by interpolation since no published information could be found covering those years. The interpolation was made between the average annual number of degrees awarded in the biennium 1951-1953 and the biennium 1959-1961. Data presented in this table are useful for showing trends but cannot be regarded as very precise for any given year until around the mid-1970s. Data on degrees awarded according to the sex of the graduate are not available prior to 1960-1961.

2/ Estimates based on extrapolation in time from the male/female totals in subsequent years.

3/ Includes 253 graduates from the University of Puerto Rico who were apparently not differentiated by nationality.

Appendix III. Graduates by School of Public Health and Degree Program, Academic Years 1961-1962 to 1978-1979 1/

ACADEMIC YEAR	ALA	BERK	UCLA	COL	HARV	HAW	ILL	J.H.	L.L.	MASS	MICH	MINN	N.C.	OKLA	PITT	P.R.	S.C.	TEX	TUL	WASH	YALE
1961-1962	--	90/5	17/0	63/2	75/7	--	--	45/6	--	--	112/1	67/2	103/3	--	39/2	31/0	--	--	28/2	--	15/0
1962-1963	--	125/3	25/2	83/1	58/7	--	--	49/8	--	--	122/3	48/0	92/0	--	48/2	32/0	--	--	35/2	--	23/1
1963-1964	--	80/2	54/4	83/1	57/3	0/0	--	63/18	--	--	147/4	103/5	74/8	--	57/13	43/0	--	--	22/2	--	25/1
1964-1965	--	146/1	51/2	101/1	68/4	0/0	--	70/11	--	--	155/1	104/4	113/10	--	47/13	37/0	--	--	56/3	--	30/2
1965-1966	--	131/6	66/8	106/2	74/9	6/0	--	67/15	--	--	150/1	97/7	103/11	--	58/15	55/0	--	--	51/5	--	32/2
1966-1967	--	176/3	112/7	75/2	69/7	11/0	--	76/20	--	--	87/4	114/1	67/13	--	53/7	40/0	--	--	54/6	--	41/1
1967-1968	--	120/4	112/10	97/1	85/12	28/0	--	88/23	17/0	--	168/3	96/7	162/14	--	62/8	70/6	--	--	48/2	--	44/1
1968-1969	--	145/4	111/8	96/0	82/11	50/0	--	107/25	25/0	--	180/3	99/10	168/15	4/6	73/11	82/0	--	--	77/8	--	55/2
1969-1970	--	141/18	112/18	86/1	90/12	54/0	--	124/27	50/0	--	205/2	96/8	199/19	31/10	95/18	99/0	--	14/0	68/8	--	47/3
1970-1971	--	166/13	108/20	108/2	81/12	71/0	0/0	116/33	60/0	7/0	200/13	115/12	184/26	31/11	111/6	**	--	42/2	83/6	3/4	56/2
1971-1972	--	191/11	167/23	83/1	127/15	68/0	0/0	126/32	72/0	15/0	269/10	137/5	244/24	36/16	149/11	**	--	71/2	95/10	14/1	42/3
1972-1973	--	131/16	176/19	68/1	118/15	77/0	21/0	174/30	95/0	19/0	262/9	135/9	213/31	51/15	156/5	**	--	85/11	106/5	23/6	61/9
1973-1974	--	205/11	171/18	66/1	141/15	66/0	41/0	180/37	112/0	22/0	285/3	132/14	232/27	82/23	148/13	**	--	80/8	101/5	35/4	51/5
1974-1975	--	201/19	151/12	62/5	147/11	57/0	62/0	175/34	90/13	27/0	335/6	101/5	199/29	43/21	156/13	**	--	78/22	94/4	29/0	91/3
1975-1976	--	245/15	190/30	88/6	186/16	97/0	89/0	159/44	100/13	53/0	386/16	144/6	205/28	53/9	143/9	88/0	--	86/29	119/8	39/3	69/4
1976-1977	--	233/26	171/13	89/9	177/14	132/0	79/0	191/36	107/10	24/0	303/19	154/3	205/22	55/12	127/12	54/0	30/0	85/19	121/3	61/0	86/8
1977-1978	1/0	255/19	171/14	102/8	196/28	143/0	79/1	177/48	136/11	27/0	241/16	193/4	221/35	38/11	112/11	**	38/0	90/16	150/3	56/5	85/7
1978-1979	13/0	203/14	212/26	105/6	217/32	152/1	67/0	213/40	101/13	35/0	254/34	166/10	228/30	40/12	116/7	64/0	24/0	93/17	140/6	56/8	84/9

SOURCES: Through 1969-1970, reports prepared by Dr. James Troupin; 1970-1971 through 1973-1974 and 1978-1979 (estimated), a special survey by the ASPH Data Collection Center; 1974-1975 through 1977-1978, ASPH Data Collection Center.

1/Data are the best available but may vary from source to source and do not always sum up to aggregated figures for all schools. School definitions of the academic year may vary in some cases from the conventional one of July through June. Below are explanations needed to assist in interpreting the table:

** = indicates missing data. -- = indicates school was presumably not yet in operation.

0 = indicates the school was presumably in operation but did not report any graduates.

The first number in each entry refers to masters degrees and the second number after the (/) refers to the number of doctorate degrees; baccalaureates are not listed.

Appendix IV. Characteristics of Graduates of Schools of Public Health, 1974-1975 to 1978-1979

Characteristics	NUMBERS						PERCENTAGES					
	1974-75	1975-76	1976-77	1977-78	1978-79	ALL	1974-75	1975-76	1976-77	1977-78	1978-79	5-YR. AVERAGE
Sex												
Male	1314	1588	1454	1416	1431	7,203	56.2	53.9	52.4	50.2	49.1	52.4
Female	1023	1357	1321	1403	1486	6,590	43.8	46.1	47.6	49.8	50.9	47.6
Total	2337	2945	2775	2819	2917	13,793	100.	100.	100.	100.	100.	100.
Race/Ethnic												
White	1445	2358	2082	2133	2179	9,897	69.6	79.9	83.9	86.5	83.1	80.6
Black	189	388	176	148	164	860	8.9	7.3	7.1	6.0	6.2	7.1
Asian/Pacific Islander	74	93	119	110	138	534	3.6	3.6	4.8	4.5	5.3	4.4
Hispanic	38	176	81	47	110	452	1.8	6.8	3.3	1.9	4.3	3.6
American Indian/Alaskan Native	20	18	19	22	28	107	0.9	0.7	0.8	0.9	1.0	0.9
Hawaiian	8	1	3	5	4	21	0.4	--	0.1	0.2	0.1	0.2
Other	--	2	--	2	--	4	--	0.1	--	--	--	--
No Response	308	39	--	--	--	347	14.8	1.5	--	--	--	3.3
Total	2077	2575	2480	2467	2623	12,222	100.	100.	100.	100.	100.	100.
Degrees Earned												
U.S. Citizens												
Bachelors	39	131	81	87	87	385	1.7	4.5	2.9	2.4	2.3	2.8
Masters	1793	2217	2223	2182	2309	10,724	79.3	76.3	80.1	77.4	79.1	78.4
Doctorate	156	194	176	210	233	969	6.9	6.7	6.4	7.4	8.0	7.1
Foreign Citizens												
Bachelors	1	2	4	4	2	13	0.1	0.1	0.1	0.1	0.1	0.1
Masters	238	322	260	329	274	1,423	10.5	11.1	9.4	11.7	9.4	10.4
Doctorate	34	38	31	27	32	162	1.5	1.3	1.1	1.0	1.1	1.2
Total	2261	2904	2775	2819	2917	13,676	100.	100.	100.	100.	100.	100.
Area of Specialization												
Biomedical/Laboratory Sciences	19	74	61	88	89	331	0.8	2.5	2.2	3.1	3.1	2.3
Biostatistics	128	141	148	159	136	712	5.5	4.8	5.3	5.6	4.7	5.2
Epidemiology	231	267	291	313	355	1,457	9.9	9.1	10.5	11.1	12.2	10.6
Environmental Sciences	274	378	373	421	446	1,892	11.7	12.8	13.4	14.9	15.3	13.6
Health Education	101	228	181	182	177	869	4.3	7.7	6.5	6.4	6.1	6.2
Health Services Administration	637	941	813	737	760	3,888	27.3	32.0	29.3	26.1	26.0	28.1
Nutrition	122	145	131	140	164	702	5.2	4.9	4.7	4.9	5.6	5.1
Occupational Safety and Health	26	43	22	19	22	132	1.1	1.5	0.8	0.7	0.7	0.9
P.H. Practice/Program Management	259	390	300	299	280	1,528	11.1	13.2	10.8	10.6	9.6	11.1
Other	540	338	455	471	488	2,292	23.1	11.5	16.4	16.6	16.7	16.9
Total	2337	2945	2775	2829	2917	13,803	100.	100.	100.	100.	100.	100.

SOURCE: ASPH Data Collection Center. Numbers include only those graduates for whom the corresponding variable is known and hence the totals recorded for one variable will not necessarily agree with those recorded for another one. Race/ethnic data are based on U.S. citizens only. The remaining characteristics include all graduates unless otherwise noted.

AREA OF SPECIALIZATION	DIFFERENTIATING CHARACTERISTICS (Pertaining to the Area of Specialization and Illustrative Ways it Contributes to Improved Health)	ILLUSTRATIVE JOBS AND JOB SETTINGS (For Graduates of the Area of Specialization)
Biostatistics Biostatistics involves the application of statistical procedures, techniques, and methodology to characterize or investigate health problems and programs.	The specialty is concerned with such activities as the collection, organization, retrieval, and analysis of data; design of experiments; comparison of different population subgroups; and the application of techniques of inference and probability to the examination of biologic, social, and environmental data. Biostatistics closely interacts with the field of Epidemiology, while also extending into the congruent areas of vital statistics and demography, computer systems, programming and analysis, and program planning and evaluation. The specialty helps to anticipate needs and improve decision-making with regard to health problems, programs, and technologies through the: development and operation of ongoing statistical information systems concerned with vital events, health status, and program operation; proper design and conduct of studies, and the analysis and interpretation of data obtained from such studies.	In local and state agencies, employment in the collection, tabulation, and analysis of statistics bearing on all aspects of health problems and programs. In state, federal, and academic settings providing assistance to investigators in the design, conduct, and data analysis of research on health problems and programs. In academic institutions, training health workers in the use and interpretation of statistics and carrying out research to discover improved ways of using statistical measures and procedures.
Epidemiology Epidemiology is the science devoted to the systematic study of the distribution and determinants of disease or disability.	As the intelligence arm of public health programs, epidemiology determines disease frequencies and trends in populations, and those factors which augment or reduce disease and disability. Epidemiology has both a descriptive and analytic role. In the former, and in conjunction with the field of Biostatistics, it makes use of the statistical methods to determine morbidity, mortality, prevalence, incidence and case fatality rates, and estimates of the risk of developing specific diseases in a given population. In its analytic role, epidemiology uses a variety of techniques to examine and evaluate data which seek to identify predisposing, precipitating, and prolonging factors bearing on disease and disability. By developing new or improved information on the distribution and determinants of disease, epidemiology helps the health system design better ways to prevent, detect, and treat disease and disability.	In health agencies at all levels epidemiologists are employed in the design and execution of studies or information systems concerned with determining the distribution and determinants of disease or disability. In academic settings epidemiologists teach, do research, and assist clinical investigators in the study of disease and in the evaluation of new or improved measures for disease prevention, therapy, and rehabilitation.

AREA OF SPECIALIZATION	DIFFERENTIATING CHARACTERISTICS (Pertaining to the Area of Specialization and Illustrative Ways it Contributes to Improved Health)	ILLUSTRATIVE JOBS AND JOB SETTINGS (For Graduates of the Area of Specialization)
Health Services Administration Health Services Administration is concerned with the application of specialized knowledge and skills in resource management in order to accomplish the effective and efficient delivery of health services.	Areas of expertise relevant to this specialization include those of planning, organizing, directing, controlling, policy formulation and analysis, financial management, economics, accounting, and operations research. Faculties of health services administration programs tend to be specialists in one of the administrative knowledge base areas, either as a basic discipline or from later specialization and research. While persons with prior professional degrees are not uncommon, students in specialized programs of health services administration tend to have recent bachelor's degrees or have been practicing administrators without other advanced training. Health Services Administrators seek to ensure that the resources available for the promotion, protection, and restoration of health are applied as effectively and efficiently as possible, consistent with the scientific knowledge base that exists about health and disease.	Health Services Administrators are employed at all levels of government and in the private sector to plan, implement, manage, coordinate and evaluate programs for the delivery of health care, and to design administrative systems appropriate for the needs of the population being served.
Public Health Practice and Program Management Public Health Practice and Program Management involves the application of specialized knowledge and skills to the planning, implementation, management, and evaluation of activities carried out relevant to selected types of health professional disciplines.	This area of specialization encompasses many of the identifiable public health programs and activities, some of which are organized according to the demographic characteristics of the target population (maternal and child health, gerontology), others according to the health problem or organ system involved (mental health, dental public health), and still others according to professional discipline (nursing, social work). Specialists in each of these programmatic areas usually have a prior professional degree in one or more health disciplines in addition to specialty training relevant to their field of choice. They seek to integrate the body of knowledge of the basic discipline (medicine, nursing, etc.) with skills relevant to public health practice (planning, program development, etc.) in order to design and implement programs appropriate to specific health needs.	Employed at all levels of government and in the private and educational sectors, these specialists assume leadership roles in community-based health care programs and systems; apply technical expertise to planning, implementation, and evaluation of technical programs within a defined organizational framework; and carry out training and research activities.

AREA OF SPECIALIZATION	DIFFERENTIATING CHARACTERISTICS (Pertaining to the Area of Specialization and Illustrative Ways it Contributes to Improved Health)	ILLUSTRATIVE JOBS AND JOB SETTINGS (For Graduates of the Area of Specialization)
Health Education Health education is concerned with the process of influencing health-related social and behavior change in human populations.	Health education specialists use specific methods, skills and program strategies to help people change to healthier life styles, to make more efficient use of health services, to adopt self-care practices wherever possible, and to participate actively in the design and implementation of programs that affect their health. Skills in the social and behavioral sciences, communication dynamics, educational theory, and community organization as well as other fields are all highly relevant to this area of specialization.	Employment is available in many different types of agencies in both the public and private sectors to identify social and health needs of population groups, adapt the health care delivery system to the needs of individuals and communities, develop and implement patient education in health care and community settings, and utilize the media effectively as a means of achieving the above.
Environmental Sciences Environmental Sciences encompasses those specialties which are concerned with the identification and control of factors in the natural environment which affect health.	Environmental Sciences specialists are concerned with the interrelationships between the characteristics of the natural environment (air, water, soil, chemicals, etc.) and man's mental and physical health. This information is used to establish limits on pollutants which the environment can absorb without detrimental effects, to develop control technology, and to implement controls as necessary for the benefit of human and animal populations. The educational background of most environmental scientists usually includes disciplinary training in one or more of the natural sciences plus advanced courses in those aspects of environmental health relevant to their primary discipline.	Employment is available at all levels of government, public and private organizations, and industry to provide technical knowledge and methods in the investigation, planning, controlling, and regulation of matters pertaining to environmental health hazards. In addition, they carry out basic and operational environmental research in education and research institutions, and provide training to community workers and interest groups in methods and techniques of environmental protection.
Occupational Safety and Health Occupational Safety and Health is concerned with the identification of health and safety hazards related to work and the work environment, and with their prevention and control.	In collaboration with many disciplines such as medicine, nursing, statistics, engineering, psychology, this area of specialization seeks to minimize ill-health, injury, and maladjustments to work that may arise as a result of man's association with work and the work enviroment.	In industry, occupational safety and health specialists are concerned with establishing the causes and effects of industrial health problems and the implementation of acceptable control programs. In government, they are involved with monitoring morbidity and mortality associated with the work environment, formulating and enforcing safety standards, investigating specific health and safety problems, and with the planning and implementation of appropriate health programs. Those employed by academic institutions are involved with the training of specialists in this field and with research.

AREA OF SPECIALIZATION	DIFFERENTIATING CHARACTERISTICS (Pertaining to the Area of Specialization and Illustrative Ways it Contributes to Improved Health)	ILLUSTRATIVE JOBS AND JOB SETTINGS (For Graduates of the Area of Specialization)
Nutrition Nutrition is concerned with the study of the interaction between nutrients, nutrition and health, and with the application of sound nutritional principles and maintenance of good health.	This broad area of specialization can be divided in two main component parts, one which is concerned primarily with the scientific study in laboratory and clinical settings of the effects of nutrients or their lack of growth, development, and health; and the other with the application of specialized nutrition knowledge and skills to improve or maintain the health of target population groups. In the former category are found persons with basic preparation in biochemistry, medicine, and related sciences; while in the latter are persons with training in dietetics, clinical nutrition, and related fields.	Employment opportunities for specialists in nutrition exist at all levels of government and in private agencies, institutions, and industry. Examples of typical job activities include the assessment of nutritional problems in individuals and population groups, development and implementation of programs which will change patterns of food consumption, and fundamental research into human and animal nutrition.
Biomedical and Laboratory Practice Biomedical and Laboratory Practice encompasses various specialty disciplines which use laboratory techniques for the diagnosis and treatment of disease, and for the investigation of conditions affecting health status.	The two main defining characteristics of this broad area of specialization are 1) the type of facilities and equipment used; and 2) the fact that it is concerned with the scientific investigation in individuals of biological and biochemical processes which affect or reflect health status. Specialists working in this area may be primarily concerned with developing new knowledge or with the application of existing laboratory-based techniques for the maintenance of health and for the prevention, early detection and treatment of disease, both in individuals and in mass screening and prevention programs.	Those trained in this area of specialization are employed at all levels of government, in medical and academic institutions, and in public and private laboratories. Illustrative job opportunities include laboratory reserach for the detection and treatment of disease, the planning and operation of laboratories, and the operation of training programs concerned both with the basic training of laboratory personnel as well as their needs for continuing education.
Other This last category encompasses a diverse group of specialities which, while not fitting within any of the preceeding, nevertheless make important contributions to the health of the public and are offered by at least some of the schools of public health. These specialities are defined in different ways such as by disciplinary background (e.g., behavioral and social sciences), by the kinds of phenomena under consideration (e.g., the study and treatment of health problems in an international setting).		Employment opportunities exist primarily at the federal and state levels, academic institutions, and in some private agencies and foundations. Skills of particular relevance to this broad area of specialization include the collection and analysis of data pertinent to the health status of defined populations; and the planning, development, and operation of programs designed to deal with particular health needs.

Introductory Comment to Bibliography

A search of the public health manpower literature was conducted in early 1979 at the University of North Carolina in Chapel Hill (Health Sciences Library). The search involved two online computer files, one established by the National Library of Medicine (MEDLARS II) and the other by the National Technical Information Service (NTIS). MEDLARS II includes several broad data bases concerned with the clinical and administrative aspects of public health manpower. In terms of the clinical and training references, the search period covered materials from 1966 to 1979, while the health planning and administrative sources covered a period from 1975 to 1979. The NTIS citations contain mostly government publications and other reports from 1970 to 1979. Nearly 700 citations were generated through MEDLARS II and slightly more than 100 references were produced using the NTIS file.

In order to locate references and to facilitate the search procedure where the exact title of a publication was not known, key terms and/or phrases such as manpower, schools of public health, utilization, distribution, and the names of various training specializations within the public health field were used. These terms are in no way exhaustive, but are mentioned in order to give the reader a better idea of how the search was conducted. The extent to which bibliographic references were produced using key words was influenced by the characteristics of the data base within each of the computer files. For example, some of the clinical references in MEDLARS II proved to be very broad and unrelated to the field of public health manpower. As a result, references found to be of marginal importance or repeated in other data sources have been deleted. Of the more than 800 references originally identified, 286 were kept and are listed in the following section. These are grouped according to manpower specialty and are sequenced chronologically starting with the most recent references.

The bibliography's length is not a good basis for judging the adequacy of the published literature on public health manpower; many important topics receive little or almost no attention. Almost three-fifths of the references have to do with manpower education and training, more than one-fourth relate to aspects of public health practitioners and practice, and by a very generous estimate, only 16% are concerned with supply and demand. Most studies tend to be quite limited in scope, data base, or setting, and are more apt to be descriptive than analytical. The more obvious gaps concerning public health manpower include: operational definition and categorization of the specialty; studies of the determinants of supply and demand; estimates of career stability in the various public health specialties; job analysis and studies into the degree of congruence between what is taught, what <u>is</u> done on the job, and what <u>should</u> be done in public health jobs; estimates and characterization of the production of public health manpower outside of schools of public health; rigorous evaluations of the major alternative modalities of public health training; and good annotated reviews of the recent literature on public health manpower. Even though the computerized bibliographic search carried out for this report identified a long list of references, one nevertheless

has the disquieting feeling that some important publications were missed. Readers are encouraged to supplement the list as feasible by sending additional references to the authors or the Association of Schools of Public Health. The table below provides a summary and necessarily approximate division of the references into the various major categories identified.

SPECIALTY AREA	PRIMARY EMPHASIS OF REFERENCE (BY PERCENTAGE)				
	Education and Training	Aspects of Practitioners and of Practice, Careers, Certification, etc.	Studies and Projections of Supply and Requirements	TOTAL	
				%	No.
General and Unspecified	47	29	24	100	38
Biostatistics	100	-	-	100	4
Dental Public Health	100	-	-	100	4
Environmental Sciences	49	32	29	100	41
Epidemiology	71	25	4	100	24
Health Administration	60	13	27	100	63
Health Education	68	20	12	100	25
Maternal and Child Health	50	50	-	100	2
Mental Health	69	8	23	100	13
Nutrition	63	11	26	100	19
Population/Family Planning	50	25	25	100	4
Public Health Nursing	37	20	43	100	44
Other	80	20	-	100	5
TOTAL PERCENTAGE	57	27	16	100	-
TOTAL NUMBER	162	79	45	-	286

*U.S. GOVERNMENT PRINTING OFFICE: 1980 624-996/1834 1-3